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PSYCHE

VOL. 54 SEPTEMBER, 1947 NO. 3

NOTES ON DILARIDÆ AND BEROTHIDÆ, WITH SPECIAL REFERENCE TO THE IMMATURE STAGES OF THE NEARCTIC GENERA (NEUROPTERA)

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To students of neuropteroid insects, as well as to entomologists interested in specialized types of holometabolous larvæ, it will be significant that the immature stages of *Nallachius* and *Lomamyia* have been found. *Nallachius* is the only Nearctic genus of Dilaridæ and contains two species in the United States, both of which were originally referred to the genus *Dilar*. *Lomamyia* is the sole Nearctic genus of Berothidæ, represented in this country by 10 species, and, like *Nallachius,* they are all relatively rare insects. With the exception of the eggs and first-stage larvæ of *Spermophorella,* an Australian berothid genus, the young stages of these two families have been entirely unknown. Though some details of the biologies of *Nallachius* and *Lomamyia* are still unknown, the main features may now be presented. Their larvæ prove to be related, though perfectly distinct, predators which attack soft-bodied insects.

The discovery and recognition of the young of these insects may be largely attributed to the collecting zeal and generous cooperation of my colleagues, William H. Anderson and Herbert S. Barber. Dr. Anderson collected the male allotype[1] of *Nallachius americanus* (McL.) in 1939, and has also collected four lots of larvæ, with

[1] Designated by Carpenter (1940) subsequent to the original description, 1881. This specimen was reared, but the cast skins were not recovered.

one lot of which two pupæ were associated. The pupæ died before maturity, but possess the characters of the adult sufficiently well to permit identification. A cast larval skin of one is identical with larvæ which he collected. This material of *americanus* was first correctly identified in 1945 by Henry K. Townes. More than 50 years ago the late H. G. Hubbard collected a single nearly fully grown larva of *Lomamyia* which could not then be identified. A similar, though fully developed, larva taken in 1941 by R. J. Kowal likewise could not be named until the key to this identification puzzle was secured through study of first-stage larvæ hatched by Mr. Barber in 1919 from eggs laid by a captive *Lomamyia*.[2] F. M. Carpenter of Harvard University made some most helpful suggestions, when he learned of the study in progress, and I am also grateful for the photograph of *Nallachius* wings (fig. 1) which he kindly offered to make. Finally, I would express my appreciation to George E. Wallace of the Carnegie Museum for the loan of adult specimens of *Nallachius americanus* and the privilege of retaining two of them for the United States National Museum.

In this paper I have included a few notes on the distribution and variation of *Nallachius americanus,* though my primary object is to compare the immature stages of *Nallachius* and *Lomamyia* morphologically and to discuss the relationship of the Dilaridæ and Berothidæ to other families in the light of present information.

Dilaridæ

The genus *Nallachius* Navas

Nallachius Navas, 1909, Mem. Real Acad. Cienc. Artes Barcelona, vol 7, pp. 627, 666. Genotype: *Dilar prestoni* McL., 1880, designated by Navas (1914).

Carpenter's revision (1940) and subsequent additions (1942, 1947) should be consulted for information on the taxonomy and distribution of the Nearctic Dilaridæ and

[2] The specific identity of this female is uncertain. It was determined as *L. flavicornis* (Walk.) by A. N. Caudell in 1919, but determinations current at that time are rendered untrustworthy by the description of several species then unrecognized. The specimen was utilized for morphological study and is not now available.

Berothidæ. The only sizable collection of *Nallachius* adults yet reported is that of Steyskal (1944), who collected six females and 21 males of *americanus* flying around a single dead tree in Detroit, Mich., during the months of June and July. It is possible that larvæ oc-

Fig. 1. *Nallachius americanus* (McL.), female, dorsal view of right wings. Length of front wing, 7.5 mm. Brookline, Pittsburgh, Pa. Photograph by F. M. Carpenter.

curred in this tree, and also that oviposition was in progress.

Previously unreported adult material of *N. americanus* consists of four males and four females from the Pittsburgh area of Pennsylvania, one male from Odenton, Md., and a male from Bainbridge, Ga. (Detailed data appear

in the section headed "Material examined.") The wings (fig. 1) are specific for this insect, but male genitalia should be examined to confirm identifications whenever possible. A photograph of the wings has not previously been published, though Costa Lima (1943, figs. 54, 55) has given excellent photographs of the Brazilian *N. prestoni.* Size variation is indicated by the Pittsburgh series, a front wing of each of the males measuring (length in millimeters) 5.1, 4.8, 4.8, 3.6, respectively, and a front wing of each of the females from the same series measuring 7.5, 6.3, 6.1, 5.6, respectively. Forewings of the Odenton and Bainbridge males measure 4.2 and 4.3 mm. Male antennæ usually include 9 pectinations (plus the apex of the central axis), though a few specimens have 10 pectinations.

Immature stages of *Nallachius americanus*

Eggs.—One female examined (opposite Homewood Cemetery) has a cream-colored egg held at the apex of the ovipositor. It measures about 0.37×0.13 mm. and is rounded oblong.

Larva.—General body shape slender, elongate, convex (fig. 6); body setæ sparse, inconspicuous, long, and slender; spiracles well developed on mesothorax and abdominal segments I–VIII, scarcely noticeable without compound microscope. Head with elongate, somewhat blunt jaws of usual Planipennia type (figs. 11, 14); no fracture line of jaws evident; mandible and maxilla subequal in size; apex of maxilla with sensory setæ and spiculelike teeth; front triangularly produced between and anterior to antennal bases; a single dark pigmented, lateral eye spot; a tiny curved spine immediately anterior to eye. Antenna with 2–5 ring segments following scape (total segments 5–8); penultimate segment enlarged, bearing postapical peglike organ (sensory?) and 2 small setæ externolaterally; apical segment with one long principal seta and several minor ones. Prementum apically incised; labial palpus with 2–5 ring segments following basal segment (total segments 5–8). Cervical region (microthorax of Tillyard, 1916) with well-developed dorsolateral lobes.

Thoracic segments without noticeable sclerotized plates; mesothoracic spiracle in fold created by small anterior subsegment. Front legs somewhat more elongate and robust than middle and hind legs. Leg (fig. 21) with femur and tibia moderately compressed; tarsus distinct but capable of little or no movement on tibia; trochanter weakly defined; front claws blunt with anterior claw decidedly shorter than posterior one (fig. 17); claws of middle and hind pairs much smaller than front ones, unequal but not conspicuously so; paired pulvilli (or similar pads) at base of claws; empodium slender, trumpet-shaped, segmented in apical third, a second line of segmentation indistinct. Abdomen uniformly, weakly sclerotized; segments I–VIII with lateral spiracle in anterior third; each lateral margin of segments I–IX (on slide-mounted specimen) with two principal lobes, each lobe with a principal seta.

Coloration: Head gamboge yellow, somewhat darker above; thorax and abdomen uniformly pale, almost colorless; front claws light brown, middle and hind claws paler.

The supposedly mature larvæ of *americanus* range in length from 4.6 mm. to 12 mm., while the number of ring segments of the labial palpus and antenna vary as indicated above, and in several cases there is a difference of one segment in right and left appendages of the same specimen. The larva from College Park is the longest and has the largest number of antennal and palpal segments, but the one from Jackson's Island is the shortest (4.6 mm.) and has one more segment in each appendage than two larvæ from University Park examined in detail (4.8 mm. long, 5 segments in each appendage). The sex of these larvæ is naturally unknown, aside from the cast skin from which a male pupa developed. Adult males average definitely smaller than females. From the evidence now at hand, it is accordingly uncertain whether all or only part of these larvæ are fully developed, whether the number of palpal and antennal segments is variable from instar to instar, as well as in larvæ of the same instar, and whether sex has a bearing on size of

larvæ or number of palpal and antennal segments. Only one species of Dilaridæ is now recorded from the eastern United States. Most but not all Neuroptera have 3 larval instars.

Pupa.—The pupa illustrated (fig. 16) is near maturity, as evidenced by well-developed genitalia and wing venation, and dark color of the well-sclerotized portions of thorax and abdomen and on the apical two-thirds of tibia. The wings are practically black, except at the bases, and the *Nallachius*-type venation may be traced. Except as indicated by stippling on figure 16, the pupa is pale. Each antenna is a simple appendage, but the pectinations of the adult are visible within, wound about the central axis in spiral fashion. Body length is 3.26 mm.

The other pupa studied is not so near maturity as the one illustrated, and, though it is clearly a male, the dark areas are scarcely developed and the wing venation cannot be readily traced.

Cocoon.—The cocoon (fig. 3) is a tightly woven white sack without a visible exterior sculpture of any kind. The outer surface is covered loosely, and without regard to pattern, with clay-yellow particles, which appear to be fragments of wood. Others appear to be the excretory pellets of wood-feeding insects and are darker. Frass and various other particles frequently occur in the galleries of wood-boring insects, which explains their presence on the cocoon of *Nallachius*.

Material of *Nallachius americanus* examined[3] (previously unreported):

Adults.—Pittsburgh, Pa., all collected by Hugo Kahl: Fern Hollow, July 15, 1911, near orchard (1 ♂); Fern Hollow, August 6, 1907, on tree trunk near hilltop (1 ♀); Southern Avenue Park, July 8, 1911, in coitu (♂, ♀); opposite Homewood Cemetery, on an oak trunk, July 9, 1910 (1 ♀); Brookline, on tree trunk, July 17, 1910 (1 ♀).

Ingram, Pa., June 28, 1931, W. D. McIlroy, Jr. (2 ♂).

Odenton, Md., August 14, 1918, on *Robinia pseudacacia*, W. L. McAtee (1 ♂).

[3] All the Pennsylvania specimens except the two from Fern Hollow, July 15, and from Brookline, are deposited in the Carnegie Museum, Pittsburgh, Pa., all other material of both *Nallachius* and *Lomamyia* in the United States National Museum.

Bainbridge, Ga., April 6, 1943, at light, H. R. Dodge (1 ♂).

Larvæ and pupæ.—Jackson's Isl., Md. (also known as Scott's Isl. or Turkey Isl., located in Potomac River 11 miles above Washington, D. C.), found May 19, 1913, near a larva of *Micromalthus,* while breaking up wood fragments taken from a decaying log, May 5; rearing unsuccessful; dead June 9; many other kinds of larvæ in same log; E. A. Schwarz and H. S. Barber, 1 larva.

Greenbelt, Md., April 13, 1938, beneath bark of moist rotten log, W. H. Anderson, 1 larva.

College Park, Md., October 18, 1942, under bark of dead oak, W. H. Anderson, 1 larva.

University Park, Md., January 28, 1945, in hard dead tulip-tree wood in galleries of living larvae of *Pentarthrinus* and *Phlœophagus* weevils, W. H. Anderson, 4 larvæ. Two pupæ in cocoons recovered from same wood sample, but not in same gallery with the 4 larvae.

Langley, Va., November 1, 1939, with bark from tree, W. H. Anderson, 1 larva.

Biological notes: While the larvæ of *Nallachius* have not been observed feeding, there is no doubt that they attack other insects, as indicated by the piercing-sucking jaws and their presence within the galleries of wood-inhabiting insects. They themselves are not equipped to bore in wood, though the rather heavy claws, particularly those of the front legs, are presumably well adapted to locomotion in galleries often somewhat choked with the frass of their would-be victims. The integument of most of the larval body is pale and weakly sclerotized, apparently an adaptation to a minimum exposure to light and the open air. Most adults evidently emerge during spring and early summer. Apparently there is a single generation per year and a 1-year life cycle. A large percentage of adults recorded were collected on or about tree trunks, and eggs are probably inserted into the cracks of dead wood or the crevices of or beneath dead bark. Judging from the long ovipositor, it is extremely unlikely that the eggs are stalked.

Berothidæ

The genus *Lomamyia* Banks

Lomamyia Banks, 1904,[4] Proc. Ent. Soc. Wash., vol. 6, p. 209.

Genotype: *Hemerobius flavicornis* Walk., by monotypy.

Two species, *flavicornis* and *banksi* Carp., are recorded from the vicinity of Washington, D. C., and it is possible that still others occur here, so the specific identity of the larvæ described below cannot be determined.

Immature stages of *Lomamyia*

Eggs.—While confined in a glass tube, a female collected at light on Plummer's Isl., Md., June 16, 1919, laid clustered stalked eggs similar to those of many Chrysopidæ. There was one cluster of 12 white eggs, each about 0.7 mm. long, attached to the end of a thread-like stalk 6 mm. long, the terminal end of the stalk being more slender than the base. There were several smaller and less perfect clusters. After 24 hours the eggs had transverse dark bars due to the development of banded embryos. Smith (1923, p. 139) has described a single infertile unstalked egg laid by a captive female of *Lomamyia*. The unstalked condition may have been abnormal.

First-stage larva.—General body shape (fig. 2) much as in *Nallachius,* head more elongate; jaws subequal in length to palpi and antennæ; 3 pairs of equal legs; maxilla dominant, with scalelike dorsal sculpture (fig. 8), the apical tenth specialized and weakly serrate (fig. 7); mandible reduced, slender, lateral; labial palpus and antenna 3-segmented, second and third segments each with numerous annulations. Front broadly produced; two lateral eye spots; cervical region and legs well developed; laterodorsal thoracic sclerites absent or inconspicuous;[5] thorax and abdomen with conspicuous reddish purple transverse bands, as shown by stippling (fig. 2).

[4] The genus *Lomamyia* was first proposed in a list of species; the formal description appeared late the following year in Banks' revision of the Nearctic Hemerobiidæ.

[5] See Killington (1936, fig. 43, p. 97).

Fully developed larva (possibly more correctly described as a prepupa, though no cocoon is associated).—Abdomen much more enlarged than head, in contrast to first instar (fig. 5); legs reduced; jaws truncate, much shorter than palpi (loss of apices by fracture possible but uncertain); maxilla with conspicuous sculpture (fig. 12). Front more produced than in the first instar, broadly rounded; anterior half of median dorsal surface of head with broadly convex area poorly demarked; posterior half with pattern of pale sutures and 3 lateral setæ. Prementum small, irregular, anterior margin entire; mentum narrowed apically, broadly rounded basally, flanked by elongate sclerites (undifferentiated cardo and stipes?); cervical region with conspicuous, laterally concave apodemes, each with a detached, V-shaped base. Front and middle legs subequal (hind legs lost); tarsus rather freely articulated with tibia (fig. 22); trochanter distinct; tarsal claws equal; no observed pulvilli at base of claws; empodium apparently broadly incised apically, otherwise much as in *Nallachius;* a definite "sole" ventrad of claws (fig. 18). Pronotum with large paired laterodorsal sclerites on anterior two-thirds, a weak transverse suture on posterior third; meso- and metanotum each with small, narrow, semilunar sclerites; anal sucker apparently well developed.

Coloration: Head, cervical apodemes, thoracic sclerites, and coxæ brown; claws and "sole" pale brown; abdomen with poorly demarked dorsal pattern of light purple transverse bands; remainder pale. The unpublished notes of H. G. Hubbard contain the following description, made from life, of the Washington larva:

"General color is purple-brown, darker on thoracic segments and almost black on the head; lighter beneath; variegated with pure white. The legs and mouth organs are translucent white. Beneath, each abdominal segment has a large triangular spot of yellowish white, which looks like the luminous glands of Lampyridæ, but was found not luminous above or below. The dorsal surface is gaily decorated with snow-white markings—viz.: On prothorax, on each side, a narrow white line beginning behind the

middle; on meso- and metathorax, on each side, just above the legs a quadrate white spot; on second, third, fourth and fifth abdominal segments, also a narrow transverse band of white extending entirely across the segment near the hind margin, the ends of the bands enlarged, rounded and slightly curved forwards; the same white band on sixth and seventh segments but interrupted or less conspicuous (obsolete); the last two abdominal segments are pale and the terminal one is a suckerlike organ, not used in progression, but assisting the insect to cling to smooth surfaces, as in *Hemerobius.*''

The slide-mounted Washington larva shows that the prothoracic laterodorsal sclerites bear several setæ, each arising from a well-developed pit. The sclerites of meso- and metanotum each bear a single posterior seta arising from a large pit. Other thoracic and abdominal setæ are sparse, inconspicuous, mainly arranged in transverse rows.

Both the Washington and Beltsville larvæ have the jaws proportionally much shorter than those of first-stage larvæ, but there is no definite fracture line, as described in *Osmylus* by Killington (1936, pp. 99, 224) and Withycombe (1923, p. 516), and the maxillæ of the Washington larva are not broken off evenly with the mandibles. Study of more material will be necessary to determine whether there is a normal shortening of the jaws subsequent to the first instar, whether there is a regular fracture prior to pupation, or whether the jaws of the two larvæ here studied were accidentally broken.

Pupa.—Unknown.

Material of *Lomamyia* examined:

Larvæ.—Washington, D. C., July 19, 1895. ''Found in the fungus garden (nest) of *Atta occidentalis*[6] in wooded knoll, on Brentwood Road, near Soldiers' Home.'' H. G. Hubbard, 1 larva.

Beltsville, Md., October 28, 1941, in fallen log, in pocket containing living and dead termites, R. J. Kowal, 1 larva.

Plummer's Isl., Md. (located in Potomac River 8 miles

[6] My friend, M. R. Smith, has informed me that the ant in question was almost surely *Trachymyrmex septentrionalis* (McCook). Specimens are not known to have been preserved.

above Washington, D. C.), hatched from eggs laid by female collected at light June 16, 1919, H. S. Barber, 6 first-stage larvæ and several eggs.

Biological notes: The first-stage larvæ reared by Mr. Barber hatched from 2-day-old eggs and were kept in a vial. His notes and those of A. N. Caudell describe these larvæ as extremely active, running very rapidly on the smooth glass surface without use of the anal sucker. A crushed fly offered as food was not touched, and they attempted unsuccessfully to pierce larvæ of ants. Living larvæ and pupæ of Scolytidæ and immature termites proved very attractive. A larva would rush up to a victim, stop, then lunge forward and pierce the prey with the jaw of one side. After the jaw was withdrawn, the head would be turned to direct the jaw of the other side toward the prey, whereupon another lunge would be made. With a lens Mr. Caudell observed the jaws inserted into scolytid larvæ. It was seen that some of the *Lomamyia* larvæ increased in size, and the scolytid larvæ were dead the following day. The *Lomamyia* larvæ unfortunately died within a few days, perhaps due to a low atmospheric humidity.

There is no indication that the Beltsville larva (fig. 5) was removed from a cocoon; its robust abdomen and very small legs may point to a recent engorgement or a sedentary life, rather than preparation for pupation. Killington (1936, p. 128) should be consulted for a discussion of neuropterous prepupæ. The Washington larva (4.9 mm. long) is apparently in an earlier stage than the Beltsville specimen (9.36 mm.), and an enlarged abdomen is not evident, though its condition is somewhat unsatisfactory. It is suggestive of nest predatism[7] that one larva was taken among ants, the other among termites. I am inclined to believe that the later larval instars of *Lomamyia* are less active than those of *Nallachius*. Snyder (1920, p. 120) reported a strange neuropterous larva which he found in a termite colony at Falls Church, Va., in 1918. His notes lead one to suspect that the larva may

[7] Wheeler, *Ants*, 1926, p. 382, has discussed enemies living in ant nests, calling them synechthrans. True commensals are of a different nature, living at the expense of but without harm to the host.

have been *Lomamyia,* but the specimen is not now available.

Although the larval feeding mechanism of *Lomamyia* is specialized to function almost identically like that of *Nallachius,* the smaller legs of the mature *Lamamyia* larva, and the fact that the front leg and claws equal the middle ones, suggest somewhat different habits. Dr. Anderson consistently sought wood-inhabiting beetle larvæ in his collecting, and five times he secured *Nallachius* larvæ or pupæ, never *Lomamyia.* This fact suggests that *Lomamyia* larvæ occupy a different habitat.

The eggs of the Australian *Spermophorella* are borne on separate stalks, according to Tillyard (1916), and the first instars are much like those of *Lomamyia.* He reported that the larvæ walked with the combined use of legs and anal sucker, moving with a looping action similar to that of Geometridæ.

Principal larval characters distinguishing *Lomamyia* and *Nallachius*

Lomamyia	*Nallachius*
1. Penultimate antennal segment without subapical peg.	1. Subapical peg present.
2. Antennæ and palpi 3-segmented, no supernumerary segments.	2. More than 3-segmented, supernumerary segments present.
3. Maxilla much larger than mandible, dominant both ventrally and dorsally.	3. Mandible and maxilla subequal; mandible conspicuous dorsally, maxilla ventrally.
4. Antennæ borne at lateral extremities of head.	4. Antennal bases much less remote.
5. Anterior margin of front broadly rounded.	5. Anterior margin acute.
6. A single simple eye at each side of head.	6. Two simple eyes at each side.
7. Several ventral sclerites in region of mentum.	7. Ventral sclerites of head reduced in number.
8. Prementum apically entire.	8. Prementum apically divided.
9. Laterodorsal thoracic sclerites well developed.	9. Absent or indistinct.
10. Legs much reduced in proportion to abdomen (mature larva).	10. Legs only moderately reduced in proportion to abdomen.
11. Front legs equal to middle (and hind?) legs.	11. Front legs larger than middle and hind legs.
12. Claws equal.	12. Claws unequal, especially those of front legs.
13. Tarsal claws with a ventral "sole."	13. No "sole" present.
14. Tarso-tibial joint mobile; trochanter distinct.	14. Tarso-tibial joint apparently not mobile; trochanter poorly developed.

The foregoing generic characters are subject to modification as larvæ of other species become known. In sorting material, the subapical peg of the penultimate antennal segment of *Nallachius* and the sculptured dorsal surface of the maxilla of *Lomamyia* have been found particularly useful characters. The dominance of the maxilla in *Lomamyia* is one of the most fundamental differences between the two genera. Withycombe (1925, p. 328) has attached considerable significance to the relative dominance of mandible and maxilla in neuropterous families. Tillyard (1916) stated that the mandible of *Spermophorella* is dominant, but his figures indicate that the first instar larva (figs. 4, 10) is very much like that of *Lomamyia* (figs. 2, 8), and it is possible that he misinterpreted the mouthparts. If that be true, the close similarity of *Spermophorella* and *Lomamyia* larvæ strongly suggests the stability of larval family characters in the Berothidæ, even when represented by genera occurring in distant parts of the world.

Family Relationships

The larvæ of neither the Berothidæ nor the Dilaridæ, as represented by the genera studied, may readily be confused with those of any other family. The terrestrial neuropterous larvæ most familiar to entomologists are Chrysopidæ and Hemerobiidæ. The latter are superficialy suggestive of Berothidæ and Dilaridæ, but in each case, as in the hemerobiid genus *Wesmælius* (fig. 9), the jaws are strongly incurved, not extending straight forward. In fact, the berothids and dilarids clearly belong to what Withycombe (1925) has termed the straight-jawed families of Neuroptera, in contrast to the many families whose larvæ consistently have strongly incurved jaws. First-instar Hemerobiidæ have a trumpet-shaped empodium, but this becomes a broad pad in later instars (fig. 20). The Chrysopidæ is one of the very few families to retain a trumpet-shaped empodium in all larval instars (fig. 19). The well-illustrated key by Townsend (1935) will enable students to recognize the families of most Nearctic neuropterous larvæ.

Withycombe placed the Dilarîdæ and Berothidæ, together with the Mantispidæ, Osmylidæ, Sisyridæ, and Myiodactylidæ, in a superfamily called the Osmyloidea. With the exception of the Myiodactylidæ, I believe that this grouping is entirely correct. Larvæ of the latter have been illustrated and described by Tillyard (1926, fig. U17), and, on the basis of larvæ, it seems clear that the family is related to the Ascalaphidæ and associated families. So far as I am aware, there was no description of myiodactylid larvæ prior to 1926, though Tillyard (1917, p. 543) mentioned the larva of *Myiodactylus* and indicated it would later be described. It is probable, therefore, that no information concerning these larvæ was available to Withycombe, and that the resemblance between Osmylidæ and Myiodactylidæ with respect to wing venation led him to associate closely the two families.

Klingstedt (1937) has suggested that the Dilaridæ may be closely related to the Raphidiodea, basing this view on chromosome structure. Tjeder (1937), who has studied the external and internal anatomy of adult Dilaridæ and Raphidiodea, points out both similarities and dissimilarities, and concludes that sufficiently close relationship is shown to justify transferring the Dilaridæ from the Neuroptera (strict sense, Planipennia of authors) to the Raphidiodea. Larval characters of the dilarids, previously unknown, impress me as more trustworthy indicators of relationship than the adult characters thus far studied, and consequently I believe the primary affinities of the Dilaridæ are with the Osmyloidea. The Berothidæ are close relatives.

The presence of an ovipositor in both raphidiids and dilarids has led Tjeder and others to suspect close relationship. A comparison of the adult female ovipositor of *Nallachius* (fig. 15) with those of mantispids of the genera *Symphrasis* and *Plega,* and with those of the raphidiid genera *Agulla* and *Inocellia* shows that there is an abrupt bend or elbow at the base of the ovipositor in the first two families which is absent from the Raphidiodea. In several other ways the Mantispidæ suggest

affinities with *Nallachius* and *Lomamyia* that appear stronger than any shown by the raphidiids.[8] Trichosors or marginal dots and dashes of the wings, discussed by Killington (1936, p. 34) and Comstock (1918, p. 167), occur in Dilaridæ, Berothidæ, and some Mantispidæ, as well as certain other families, but not in the Raphidiidæ that I have examinel. The swollen body and reduced legs of mature *Lomamyia* larvæ suggest an approach to the parasitic habit, with even more swollen body, of Mantispidæ. The claws and empodium, as well as certain other structures discussed by Withycombe (1925), of first-stage larvæ of Mantispidæ are very similar to those of *Lomamyia*. I have examined larvæ of an unidentified mantispid found by J. C. Bridwell in 1938 in alcohol in which spiders had been collected. In addition to the Nymphidæ and Myiodactylidæ, the Berothidæ, Mantispidæ, and Chrysopidæ are known to lay stalked eggs. While raptorial front legs give the Mantispidæ a quite different superficial appearance from either Dilaridæ or Berothidæ, they are regarded by Withycombe (1925, p. 329) as a specialization rather than as evidence of fundamental lack of relationship.

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Abbreviations

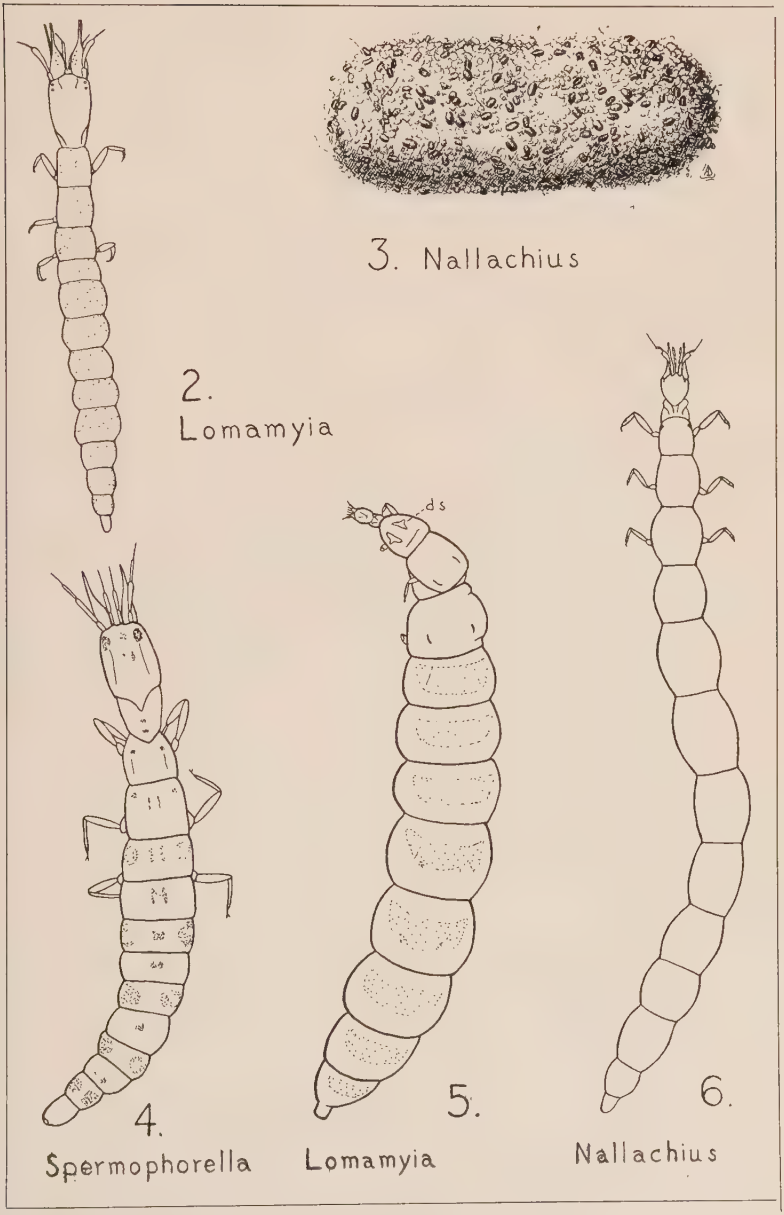
cr = cervical region
cx = coxa
ds = dorsolateral thoracic sclerites of pronotum
em = empodium
fe = femur
m = mentum
md = mandible
mx = maxilla
ob = base of ovipositor
pe = sensory (?) peg of antenna
pm = prementum
so = "sole" of tarsal claws
S7 = seventh sternum
ta = tarsus
ti = tibia
tr = trochanter

(Figure 3 drawn by Arthur D. Cushman, other drawings by the author.)

PLATE 11

Fig. 2. *Lomamyia* sp., first-instar larva, dorsal view, right middle leg missing. Length, 2.04 mm.
Fig. 3. *Nallachius americanus,* cocoon. Length, 3.26 mm.
Fig. 4. *Spermophorella disseminata* Till., first-instar larva, dorsal view. Length, about 2.5 mm. (Adapted from Tillyard, Proc. Linn. Soc. N. S. Wales, vol. 41, pl. 18, fig. 32, 1916.)
Fig. 5. *Lomamyia* sp., mature larva, dorsal view. Beltsville, Md. Length, 9.36 mm.
Fig. 6. *Nallachius americanus,* mature larva, dorsal view. College Park, Md. Length, 12 mm.

PSYCHE, 1947 VOL. 54, PLATE 11

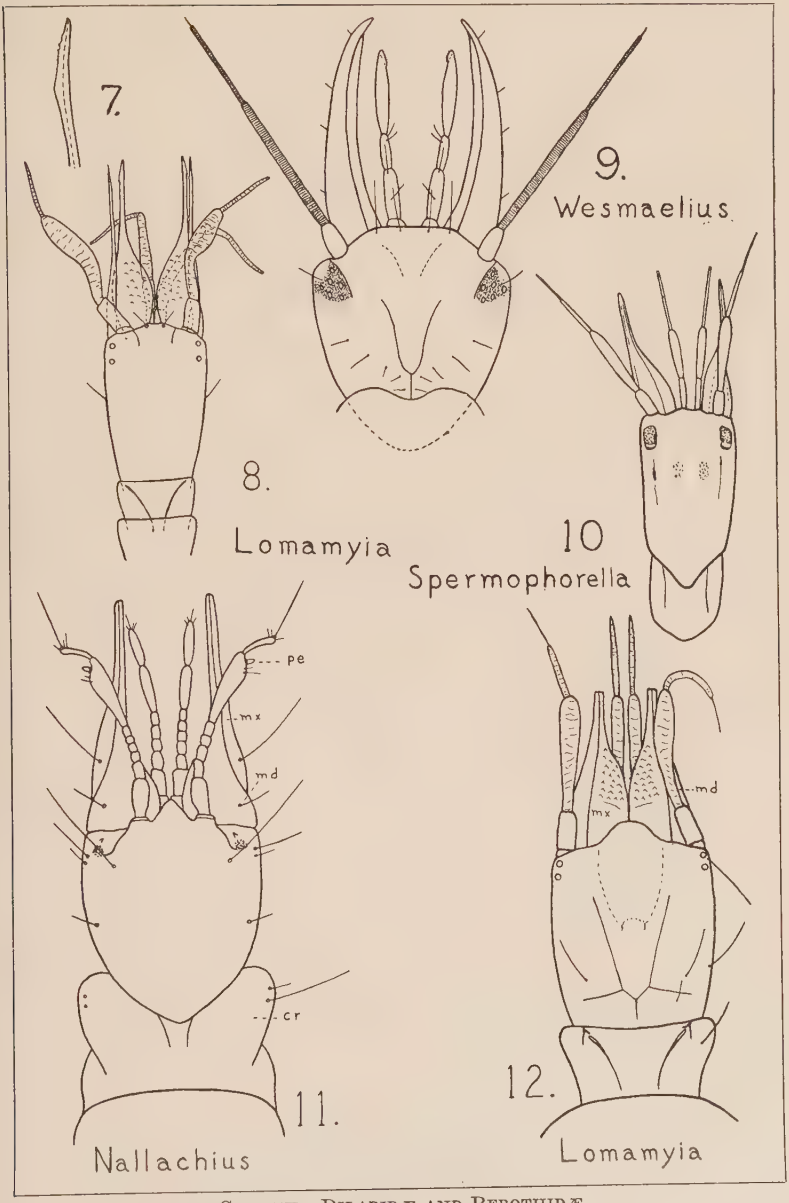


GURNEY—DILARIDÆ AND BEROTHIDÆ

PLATE 12

Fig. 7. *Lomamyia* sp., first-instar larva, apical fourth of left maxilla, dorsal view.
Fig. 8. Same specimen as fig. 7, dorsal view of head.
Fig. 9. *Wesmaelius quadrifasciatus* (Reut.), mature larva, dorsal view of head. (Adapted from Killington, A Monograph of the British Neuroptera, vol. 1, fig. 44, A, 1936.)
Fig. 10. *Spermophorella disseminata*, first-instar larva, dorsal view of head and neck. (Adapted from Tillyard, l. c., fig. 33.)
Fig. 11. *Nallachius americanus*, mature larva, dorsal view of head and neck. Same specimen as in fig. 6.
Fig. 12. *Lomamyia* sp., mature larva, dorsal view of head and neck. Same specimen as fig. 5.

PSYCHE, 1947 VOL. 54, PLATE 12



GURNEY—DILARIDÆ AND BEROTHIDÆ

PLATE 13

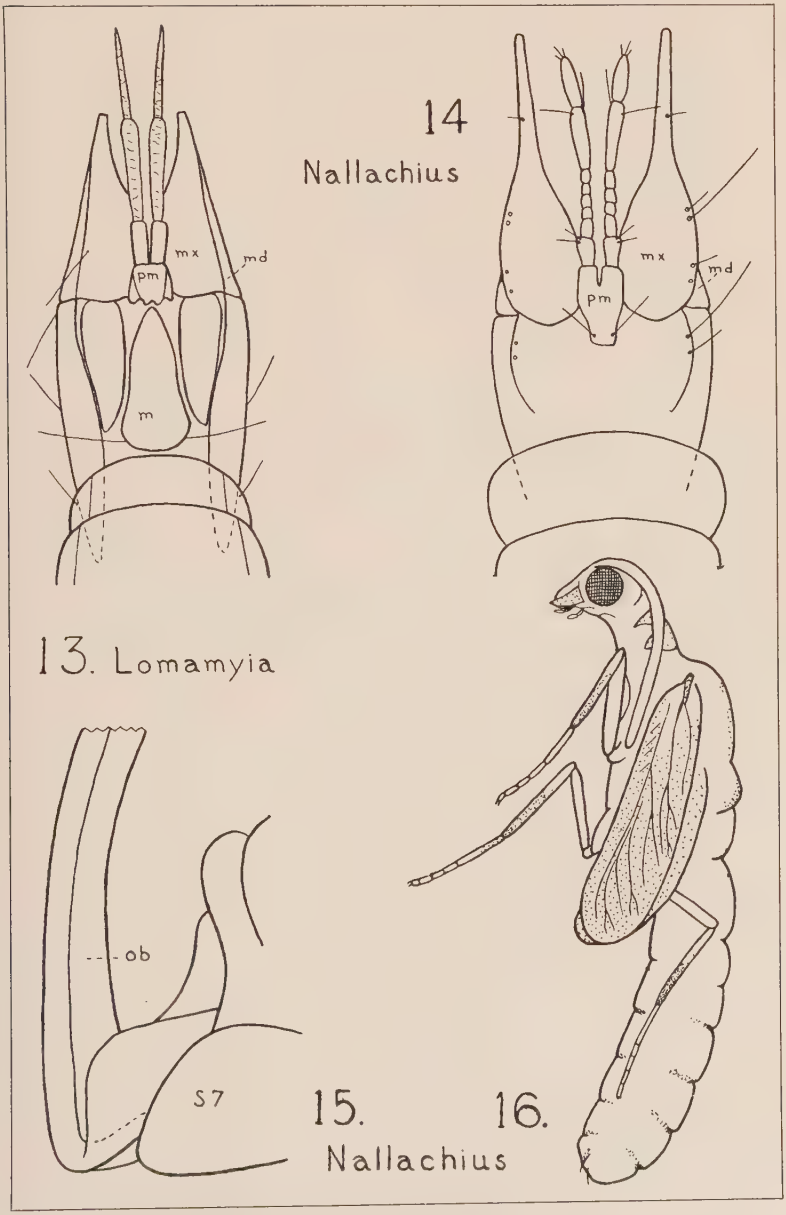
Fig. 13. Same specimen as fig. 12, ventral view of head and neck, antennæ omitted.

Fig. 14. *Nallachius americanus,* mature larva, ventral view of head and neck, antennæ omitted. Same specimen as fig. 6.

Fig. 15. Same, adult female, right lateral view of apex of abdomen, only base of ovipositor shown. Brookline, Pittsburgh, Pa.

Fig. 16. Same, pupa, left lateral view. Length, 3.26 mm.

PSYCHE, 1947 VOL. 54, PLATE 13

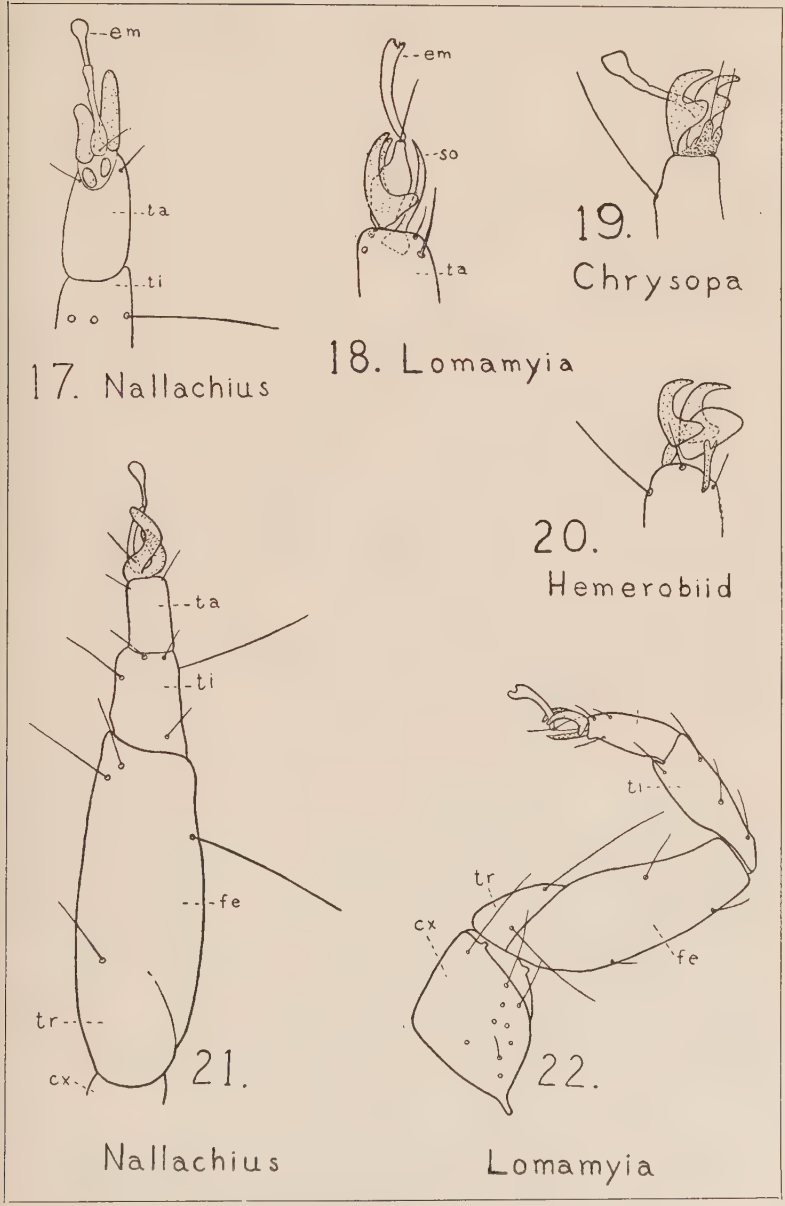


GURNEY—DILARIDÆ AND BEROTHIDÆ

PLATE 14

Fig. 17. Same, apex of right front leg, ventral view. University Park, Md.
Fig. 18. *Lomamyia* sp., apex of left middle leg, anteriolateral view. Same specimen as fig. 5.
Fig. 19. *Chrysopa* sp., apex of right middle leg, ventrolateral view. Chipley, Fla.
Fig. 20. Unidentified hemerobiid, apex of right middle leg, ventrolateral view. Mexico.
Fig. 21. *Nallachius americanus*, mature or nearly mature larva, right front leg, anterior surface, femur turned into ventrolateral view, only coxal attachments shown. Greenbelt, Md.
Fig. 22. *Lomamyia* sp., mature larva, right front leg, anteriolateral view. Same specimen as fig. 5.

PSYCHE, 1947 VOL. 54, PLATE 14



GURNEY—DILARIDÆ AND BEROTHIDÆ

NEW SPECIES AND RECORDS OF NORTH AMERICAN HYDROPTILIDÆ (TRICHOPTERA)

By D. G. Denning
University of Wyoming, Laramie, Wyoming

At present approximately 115 species of Hydroptilidæ have been recorded from North America north of Mexico. Because of the difficulty in collecting this group of Trichoptera, due primarily to their small size and secluse habits, the distribution of all the species is inadequately known. Probably a large number of new species remain to be discovered. The bionomics of most of the species is unknown and many of the species are as yet known only from the male.

A recent study of the Hydroptilidæ in the University of Minnesota collection has resulted in the establishment of a number of very interesting new distributional records, as well as the recognition of several new species. Holotypes are deposited in the collection of the University of Minnesota.

I wish to express my appreciation to Dr. C. E. Mickel for making this collection available for study, and to Dr. Mickel, Dr. Granovsky, Mr. Kretzschmar, Mr. Wirth and others for collecting this material.

Leucotrichia pictipes (Banks)

This fairly common species has been recorded from swiftly flowing streams in most of the northern states from New York to Oregon. Minnesota: Pine Co., Snake River, May 28, 1935 (H. E. Milliron), 5 males. Anoka Co., July, 1939 (D. G. Denning), 1 male. Carlton Co., St. Louis River, Aug. 11, 1940 (D. G. Denning), 40 males, 5 females. Cook Co., Temperance River, May 30, 1941 (H. P. Nicholson), 1 male. Idaho: St. Anthony, June 28, 1938 (H. S. Telford), 12 males, 8 females.

Agraylea multipunctata Curtis

This Holartic species is one of the most common Hydroptilidæ in Minnesota. Available records indicate

it is present from early spring to September. The first definite record from North Dakota is recorded herein. Minnesota: 97 males, 161 females from all portions of the State, April to Sept. North Dakota: Valley City, July 15, 1939 (D. G. Denning), 2 males, 1 female. Wahpeton, July 16, 1937 (D. G. Denning), 2 males, 14 females. British Columbia: Cowichan Lake, August, 1940 (C. P. Idyll), 3 males, 1 female.

Ithytrichia clavata Morton

This is the first record of the species from Minnesota, although it is known to have a wide range. Minnesota: Crookston, June 16, 1941 (D. G. Denning), 1 male, Hallock, light trap, July 7, 1937 (D. G. Denning), 3 males.

Ochrotrichia stylata (Ross)

Previously known from the western part of Wyoming; these are the first records from the eastern portion of the state. Wyoming: Guernsey, N. Platte River, Sept. 6, 1946 (D. G. Denning), 1 male. Near Wheatland, Blue Grass Creek, Aug. 22, 1946 (D. G. Denning), 5 males, 7 females.

Oxyethira serrata Ross

This species has previously been recorded from Illinois, New York and Wisconsin by Ross. The following records extend its known distributions considerably. Minnesota: St. Paul, light trap, July 14, 1935 (A. A. Granovsky), 1 male. St. Paul, light trap, Aug., 1934 (A A. Granovsky), 5 males, 4 females. Cass Co., at light, June 17, 1937 (R. H. Nagel), 3 males, 4 females. Cass Lake, light trap, August 1–15, 1934 (A. A. Granovsky), 1 male, 3 females. British Columbia: Cowichan Lake, August, 1940 (C. P. Idyll), 1 male.

Oxyethira verna Ross

Louisiana: Baton Rouge, April, 1947 (W. W. Wirth), 12 males.

Oxyethira obtatus n. sp.

This species can be distinguished from other members of the genus by the apical semi-membranous processes of

the ædeagus, the terminally forked condition of the internal sclerotized tube of the ædeagus and several other details of the male genitalia.

Male.—Length 3.2 mm. Genitalia as in figs. 1, 1A, and 1B. Mesal projection of seventh sternite small, acute. Lateral lobes of eighth segment produced into a triangular process, heavily setose, deeply incised dorsally; dorsad and mesad to this lobe appears a long attenuated process, directed gradually ventrad, bearing no setæ. Most of ninth segment withdrawn into eighth, caudolateral corner irregular, apparent claspers projected caudad (and slightly dorsad in paratype) beyond remainder of genitalia, slender, subacute, bearing a few minute setæ distally. Viewed from ventral aspect, fig. 1B, claspers slender, diverging mesad, separated by a concave serrate ventral plate. Tenth tergite heavily sclerotized, all but a small portion hidden in ninth segment; when seen from lateral aspect it appears as a somewhat inverted U-shaped structure, caudad branch digitate; viewed ventrally, fig. 1B, apices truncate, almost touching on meson, base arcuate. Ædeagus with base wide, spiral filament encircles tube once, long and slender, extending along side of tube nearly to apex; apical portion divided into two prominent semi-membranous processes, the shorter one bearing a large and two smaller spines, the longer one bearing a single large spine; near their base the internal sclerotized tube terminates as a fork in a small semi-membranous process.

Holotype, male.—St. Paul, Minnesota, August 1, 1934, light trap (A. A. Granovsky).

Paratype, male.—Anoka Co., Minnesota, July, 1939 (D. G. Denning) (specimen damaged).

Orthotrichia americana Banks

Records of Ross and the writer indicate that this species is widely distributed at least through the eastern half of United States. Minnesota: St. Paul, light trap, August 1, 1934, 4 male, 3 female; July 14, 1935, 2 male; June 20, 1935, 1 male (A. A. Granovsky).

Orthotrichia cristata Morton

The following records extend the known distribution of the species to Louisiana in the South and Minnesota in the North. Minnesota: St. Paul, light trap, July 14, 1935, 3 male (A. A. Granovsky). Louisiana: Baton Rouge, April, 1947, 57 male (W. W. Wirth).

Hydroptila armata Ross

The collecting of this species in the treeless plains of northwestern Minnesota is a very interesting extension in its known range. Minnesota: Washington Co., May 10, 1941, 5 male, 7 female (G. Kretzschmar). Crookston, Sept. 4, 1936, 1 male, 1 female (D. G. Denning).

Hydroptila spatulata Morton

This is the first definite record of the species from Minnesota. Minnesota: St. Paul, Aug. 1, 1934, 1 male, 2 female, light trap (A. A. Granovsky).

Hydroptila hamata Morton

Ross has recorded this species from southern Mexico, Ontario and widely scattered areas in the United States. The following constitutes the first records from Minnesota. Minnesota: Taylors Falls, August, 1937, 1 male (Carol J. Palmer). Washington Co., May 10, 1941, 1 male (G. Kretzschmar).

Hydroptila amœna Ross

Known previously from Illinois and Oklahoma; the Minnesota record indicates a wide range for this species. Minnesota: St. Paul, light trap, August, 1934, 2 male (A. A. Granovsky).

Hydroptila waubesiana Betten

The species is now known to occur from the Hudson Bay to the Mississippi delta. The following new distributional records make this species one of our most widely distributed Hydroptila. Minnesota: Rum River, reared, March 11, 1934, 1 male, 1 female (D. G. Denning). Cass Lake, light trap, August 1–15, 1934, 2 male (A. A.

Granovsky). Crookston, light trap, July 3, 1937, 1 male (D. G. Denning). Anoka Co., Coon Creek, June 4, 1937, 1 male, 1 female (D. G. Denning). North Dakota: Wahpeton, July 11, 1934, 1 male, 1 female (D. G. Denning). Manitoba: Churchill, light trap, August 6, 1937, 1 male (D. G. Denning).

Hydroptila grandiosa Ross

Although widely distributed in Central United States this is the first record from Minnesota. Minnesota: Anoka Co., Coon Creek, June 7, 1937, 1 male, 1 female (D. G. Denning).

Hydroptila albicornis Hagen

The records of Ross show the species to be widely distributed; the Minnesota record extends the known range in a northwestwardly direction. Minnesota: Cass Lake, light trap, August 1–15, 1934, 3 male (A. A. Granovsky).

Hydroptila consimilis Morton

This is a common species now known to extend from Texas to the Hudson Bay. Minnesota: St. Paul, light trap, August 1, 1934, 1 male, 3 female (A. A. Granovsky). Crookston, at light, July 4, 1937, 2 male, 1 female (D. G. Denning). Manitoba: Churchill, August 2, 43 male, 34 female (D. G. Denning). Churchill, light trap, August 6, 1937, 1 male (D. G. Denning). Churchill River, 20 miles S. of Churchill, August 5, 1937 (D. G. Denning), 5 male, 15 female.

Hydroptila perdita Morton

Ross has recorded this species from Arkansas, Illinois, Michigan, New York, Ontaria and Pennsylvania. Minnesota: Carlton Co., St. Louis River, Aug. 11, 1940, 1 male (D. G. Denning). St. Paul, light trap, July 14, 1935, 1 male (A. A. Granovsky).

Hydroptila ajax Ross

The range of *ajax* is poorly known; the following records extend its known range considerably to the North

and west. Minnesota: Washington Co., May 10, 1941, 1 male (G. Kretzschmar). Wyoming: Guernsey, N. Platte River, Sept. 6, 1946, 1 male (D. G. Denning).

Hydroptila arctia Ross

This species has not been recorded since its original description in 1938 from Idaho. British Columbia: Cowichan Lake, August, 1940, 2 male, 1 female (C. P. Idyll).

Hydroptila acoma n. sp.

This species can readily be distinguished from other members of the genus by the large spur arising from the apical portion of the ædeagus.

Male.—Genitalia as in figs. 2, 2A and 2B. Lateral lobe of ninth segment acute, slightly upturned, extended caudad about one-half length of claspers. Tenth tergite semi-membranous, mesal incision deep, lateral portions with apices acute and diverging; seen from lateral aspect, fig. 2, distal portion directed dorsad. Claspers slender throughout, divergent, apex truncate, beset with short scattered setæ, between claspers appear two prominent caudad directed tubercles. Ædeagus with basal portion flared, narrowed just before spiral process which encircles ædeagus one and one-half time, its apex lying along side of tube and extending about midway to apex; seen from lateral aspect, fig. 2B, a large acute spur arises at right angles from apical portion.

Holotype, male.—Morgan Hill, California, at light, August 8, 1941 (Roland Johnson) (specimen with head missing).

Hydroptila valhalla n. sp.

This species belongs to the *perdita* Morton group of Hydroptila; it can be readily separated from other species of that group by the curious ædagus and the dorsad directed mesal portion of the tenth tergite.

Male.—Length 3 mm. Genitalia as in figs. 3, 3A, 3B, 3C. Mesal projection of seventh sternite short, apex acute. About half of the eighth segment telescoped into seventh segment. Claspers slender throughout, fig. 3C,

divergent, apex acute, darkened and directed laterad, base hidden in ninth segment, which in turn is withdrawn into eighth and seventh segments. Tenth tergite entire, semi-membranous, extending caudad beyond any other portion of genitalia; lateral margins somewhat more heavily sclerotized than remainder; mesal lobe sub-triangular when viewed from dorsal aspect, fig. 3. Ædeagus long and slender, basal portion nearly straight, narrowed toward center then suddenly widened, apparently forms a distinct division from apical portion which is bulbular at base then constricted to an acute apex, entire apical portion turned laterad when viewed dorsally, turned ventrad when viewed from lateral aspect.

Holotype male.—Taylors Falls, Minn., August 1937 (C. J. Palmer).

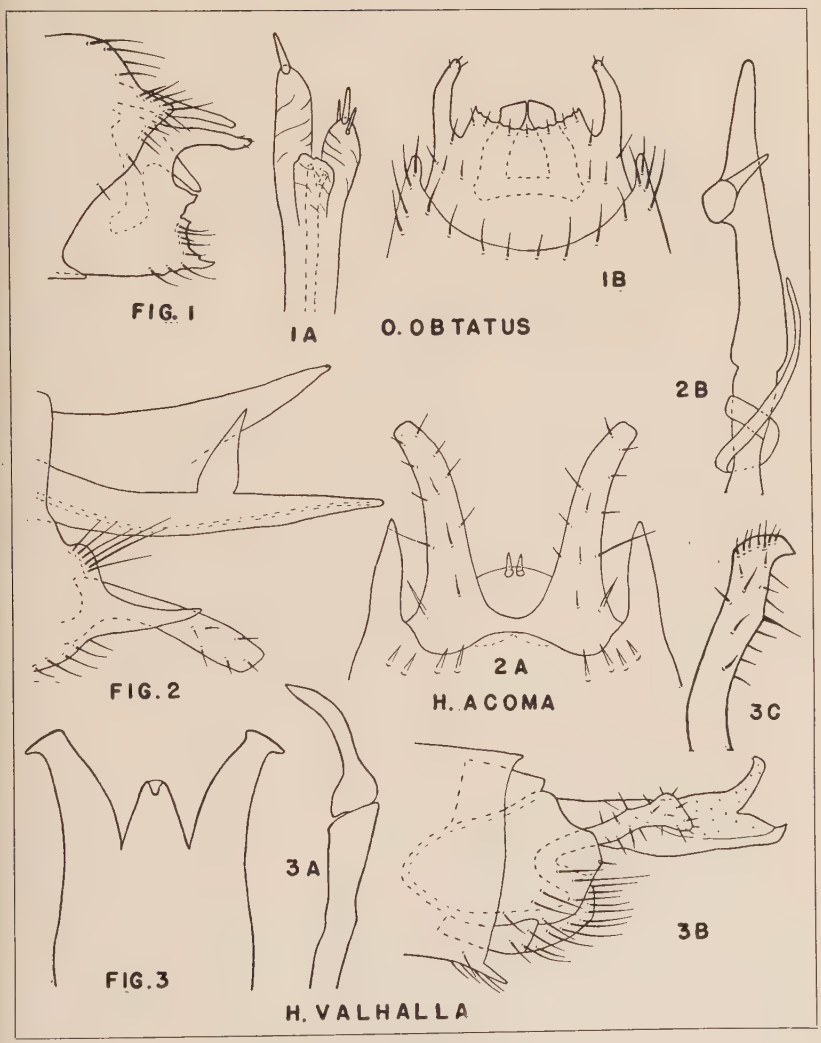
Mayatrichia ayama Mosely

The available distributional records of Ross indicate this species is widespread; the Minnesota record is an extension in the known northern limits of its range. Minnesota: Washington Co., May 10, 1941, 1 male (G. Kretzschmar).

Explanation of Plate 15

Fig. 1. *Oxyethira obtatus*, male genitalia, lateral aspect; 1A, apex of ædeagus; 1B, ventral aspect of male genitalia.
Fig. 2. *Hydroptila acoma*, male genitalia, lateral aspect; 2A, ventral aspect of male genitalia; 2B, ædeagus.
Fig. 3. *Hydroptila valhalla*, male genitalia, dorsal aspect; 3A, ædeagus; 3B, lateral aspect of male genitalia; 3C, clasper.

PSYCHE, 1947 VOL. 54, PLATE 15



DENNING—TRICHOPTERA

HOSTS OF CERTAIN NEW YORK TICKS

By George Anastos

Biological Laboratories, Harvard University

The records of ticks contained in this paper are based upon material collected by Mr. R. V. Nardy and Mr. William M. Machado under the general supervision of Dr. Donald L. Collins of the New York State Science Service.

The collection was made at the eastern end of Long Island, New York, from May 10, 1946, to September 9, 1946, at three stations: Montauk Point, Hither Hills State Park, and Hook Pond (East Hampton). It comprised 992 larvæ, nymphs and adults, the following species being represented: *Dermacentor variabilis* (Say), *Hæmaphysalis leporis-palustris* (Packard), *Ixodes cookei* Packard, *Ixodes dentatus* Neumann, *Ixodes muris* Bishopp and Smith, and *Ixodes scapularis* Say.

The host distribution represented by this survey is extensive and includes 17 species of birds and mammals. The ticks were taken mostly from trapped or shot animals; only a few specimens were dragged from grass or taken off people. The host distribution is as follows:

Birds[1]

Catbird, *Dumetella carolinensis* (Linnæus).—*Ixodes muris* (16 nymphs, 2 larvæ off 6 birds).

Brown thrasher, *Toxostoma rufum* (Linnæus).—*Ixodes muris* (9 n. off 1 bird).

Eastern or American robin, *Turdus migratorius migratorius* Linnæus.—*Ixodes muris* (22 n. off 2 birds).

Red-eyed towhee, *Pipilo erythrophthalmus erythrophthalmus* (Linnæus.)—*Ixodes muris* (18 n., 9 l. off 2 birds).

Eastern song sparrow, *Melospiza melodia melodia* (Wilson).—*Ixodes muris* (6 n., 1 l. off 3 birds).

[1] Bequaert, J. C. 1946. *The Ticks or Ixodoidea, of the Northeastern United States and Eastern Canada.* Entomologica Americana, XXV, No. 2, pp. 73–232.

Mammals

Short-tailed shrew, *Blarina brevicauda aloga* Bangs.—*Dermacentor variabilis* (1 l. off 1 shrew); *Ixodes muris* (4 n., 9 l. off 6 shrews).

Long-tailed shrew, *Sorex parvus* (Say) (= *cinereus* True).—*Dermacentor variabilis* (1 l. off 1 shrew); *Ixodes muris* (6 l. off 1 shrew).

Raccoon, *Procyon lotor lotor* (Linnæus).—*Ixodes muris* (1 n. off 1 raccoon).

Skunk, *Mephitis nigra* (Peale and Beauvois).—*Dermacentor variabilis* (1 male, 3 females off 1 skunk); *Ixodes muris* (69 n. off 1 skunk).

Red fox, *Vulpes fulva* (Desmarest).—*Ixodes cookei* (5 n. off 1 fox); *Ixodes muris* (29 n., 1 l. off 1 fox).

Man (accidental host).—*Ixodes muris* (1 n., 1 l.); *Ixodes scapularis* (1 female).

Chipmunk, *Tamias striatus lysteri* (Richardson).—*Ixodes muris* (54 n. off 2 chipmunks).

Gray squirrel, *Sciurus carolinensis carolinensis* (Gmelin). *Dermacentor variabilis* (1 n. off 1 squirrel); *Ixodes muris* (125 n., 4 l. off 4 squirrels).

White-footed or deer mouse, *Peromyscus leucopus fusus* Bangs.—*Dermacentor variabilis* (17 n., 29 l. off 22 mice); *Ixodes muris* (138 n., 105 l. off 33 mice).

Meadow mouse, field mouse, or vole, *Microtus pennsylvanicus pennsylvanicus* (Ord.)—*Dermacentor variabilis* (6 n., 3 l. off 9 mice); *Ixodes muris* (5 females, 15 n., 12 l. off 10 mice).

Eastern cottontail rabbit, *Sylvilagus floridanus mearnsi* (Allen).—*Dermacentor variabilis* (1 male, 2 females, 1 n. off 3 rabbits); *Hæmaphysalis leporis palustris* (42 males, 18 females, 13 n., 14 l. off 9 rabbits); *Ixodes dentatus* (9 males, 12 females, 15 n., 2 l. off 8 rabbits); *Ixodes muris* (66 n., 34 l. off 7 rabbits).

Virginia deer, *Odocoileus virginianus borealis* (Miller). —*Ixodes muris* (18 n. off 1 deer).

Dragged from the grass.—*Dermacentor variabilis* (1 female); *Ixodes scapularis* (10 males, 4 females).

During this survey *Ixodes muris* has been observed and recorded for the first time from the long-tailed shrew,

gray squirrel, Eastern cottontail rabbit, red fox, chipmunk, raccoon, skunk, Virginia deer, red-eyed towhee, catbird, Eastern or American robin, and brown thrasher. This makes twelve new hosts for the larval and nymphal forms of *Ixodes muris* Bishopp and Smith. Also recorded for the first time was the larval form of *Dermacentor variabilis* (Say) from the long-tailed shrew. This represents the first record of any species of tick taken from the long-tailed shrew in the Northeastern United States.

All identifications recorded for the first time were verified by Dr. Joseph C. Bequaert, Curator of Insects, Museum of Comparative Zoölogy, to whom the writer is indebted for his kind and valuable assistance.

Sphindidæ and Cisidæ (coleoptera)

During May, 1945, species of this family were found swarming in the small, crowded, woody fungi on standing dead and fallen trees and also stumps. There were many of what appears to be *Sulcacis lengi* Dury, *Cis fuscipes* Mellie, *Ennearthron thoracicorne* Zieg., *Octotemnus lævis* Csy., and *Sphindus americanus* Lec. They had about all disappeared by the end of June in Mass. About the same species and under the same conditions were found at Paris, Me., with the addition of *Eurysphindus denticollis* Lec., which occurred in a flat, brown fungus of a soft smut-like consistency on a partly uprooted poplar in the woods. This has been taken before on the same species of fungus on the top of a stump at Monmouth, Me., June 27, 1912.—C. A. Frost.

AN INTERESTING OCEANIC SPECIES OF *CERIOIDES* (DIPTERA; SYRPHIDÆ)[1]

By F. M. Hull
University of Mississippi

I am indebted to Dr. Joseph Bequaert, Curator of Insects at the Museum of Comparative Zoölogy, for calling my attention to the following interesting species of *Cerioides*.

Cerioides (Tenthredomyia) williamsi n. sp.

Related to *oceanica* Hull; differing in the pattern of the yellow markings.

Male. Length about 16 mm., including the downflexed abdomen, and including antennæ (2 mm.). *Head:* vertex and front shining black and almost bare. Upon the front there is on either side a sunken, hemicircular, opaque black pubescent, eye marginal area; at the upper end of this area there is a small patch of brownish-white pubescence. The face is dully shining black, with a sharp, wide, pale, yellow stripe on either side; this stripe margins the eyes on the upper half to the upper limits of the antennal pedicel, and below the stripe narrows as it is directed along the anterior, black cheek margins to the epistoma which it just fails to reach. The antennæ are entirely velvet black; the first segment is barely longer than the third, the third a trifle longer than the second; the pedicel is about as long as the second segment. *Thorax:* brilliant shining black with large, bright, pale yellow spots. These spots consist of the humeri, a spot on each side at the lateral end of the transverse suture (notopleural), a vertical spot covering most of the mesopleura, and all the scutellum except for a black, round, middle portion, which does not quite reach its posterior margin. *Abdomen:* broad at base, but little constricted, everywhere shining black, and with faint blue-purple luster apically. The narrow posterior mar-

[1] Published by a grant from the Museum of Comparative Zoology at Harvard College.

gin of the second segment, and still more narrow margin of the third segment is pale yellow. The abdomen is strongly flexed downward beginning with the third segment, its extremely short, everywhere wholly appressed pile is white except broadly over the middle of the second segment where it is black. There is a small, lateral yellow spot on the sides of the first segment, scarcely discernible from above. *Legs:* blackish brown, nearly the basal half of all tibiæ whitish. All pile white; femoral setæ black, very sharp pointed. *Wings:* hyaline, the anterior border as far as the spurious vein very dark sepia brown, without evident lighter areas, even in the costal cell. Loop of third vein very shallow, and with a short spur.

Holotype: a male, Noumea, New Caledonia, October 16, 1940 (F. X. Williams). *Paratypes:* 2 males, La Foa, New Caledonia (C. L. Remington). Holotype in the Museum of Comparative Zoölogy (No. 27559). There is a paratype in the collection of the author and another in the Museum of Comparative Zoölogy.

Dr. Bequaert has kindly called my attention to the wasp which mimics this fly. The wasp model is *Pachymenes quodi* Vachall, a Eumenid. Mr. Williams, in the *Proceedings of the Hawaiian Entomological Society,* 1945, Vol. XII, plate xx, illustrates the fly and the wasp and calls attention to other mimics.

NOTES ON SPIDERS FROM PUERTO RICO[1]

By Elizabeth B. Bryant
Museum of Comparative Zoölogy

Recently the Museum of Comparative Zoölogy received a small vial of spiders from the Luquillo Mountains in the eastern part of Puerto Rico, collected by Mr. Harry Beatty, at about 3,000 feet elevation. It is a section of the island from which Dr. Petrunkevitch had little material when he published "The Spiders of Porto Rico," 1929–1930, so it is not surprising that among the fourteen species, four are new and three others have never been reported from the island before.

The following is a list of the species found. The asterisk (*) denotes the first time the species has been recorded from the island.

Family Oönopidæ

♂ *Stenoönops portoricensis* Petr.

Family Theridiidæ

♂ ♀ **Allodipœna dianæ** spec. nov.
♀ *Conopistha argyrodes nephilæ* (Tacz.)
*♀ *Rhomphæa fictilum* (Hentz)

Family Linyphiidæ

♀ *Erigone* ?

Family Argiopidæ

♂ *Argiope argentata* (Fabr.)
♂ **Tetragnatha parva** spec. nov.

Family Thomisidæ

*♂ *Misumenops bellulus* (Banks)

Family Clubionidæ

♀ *Clubiona desecheonis* Petr.
♀ *Wulfila immaculata* Banks

[1] Published by a grant from the Museum of Comparative Zoology at Harvard College.

Family Salticidæ

♀ **Agobardus blandus** spec. nov.
♂ ♀ **Habronattus pretiosus** spec. nov.
♀ *Hentzia antillanus* Bryant
*♂ *Sidusa mona* Bryant

Family Theridiidæ

Genus **Allodipœna** gen. nov.

Cephalothorax almost as wide as long, anterior margin about half the greatest width, cephalic portion high, extending on the same level for more than half the length of the cephalothorax and then falling abruptly to the posterior margin, no thoracic groove or depression; *eyes*, anterior row recurved, a.m.e. separated by less than a diameter, posterior row slightly procurved, p.m.e. largest of the eight, about twice the diameter of a.m.e., separated by less than a diameter, lateral eyes touching; *maxillæ* about twice as long as the labium and inclined; *sternum* triangular, widest between the first coxæ, almost as wide as long, slightly convex, fourth coxæ separated by more than a diameter; legs, 1–2–4–3, quite short, with no spines.

Genotype *Allodipœna dianæ* spec. nov.

The genus *Allodipœna* differs from the genus *Dipœna* by the small anterior median eyes and the quite different quadrangle. It differs from the genus *Theridion* by the high cephalic portion, the large posterior median eyes, the convex sternum and the relatively short legs.

Allodipœna dianæ spec. nov.

Figures 1, 2, 3, 4

Female. Length, 1.5 mm., ceph. 0.6 mm., abd. 0.8 mm. long, 1.2 mm. wide.

Cephalothorax pale greenish-yellow with a large median shield-shaped dark spot that anteriorly is carried by curved lines to the lateral eyes, three-quarters as wide as long, anterior margin broad, cephalic portion high and extending on the same level for more than half the length of the cephalothorax and then falling abruptly to

the posterior margin, no thoracic groove; *eyes,* anterior row recurved, a.m.e. convex, diurnal, separated by about a diameter and from a.l.e. by a little less, a.l.e. smaller than a.m.e., posterior row procurved, p.m.e. a broad oval, largest of the eight, heavily ringed with red, separated by less than a diameter and from p.l.e. by fully a diameter and a half, lateral eyes touching, p.l.e. larger than a.l.e.; *quadrangle* wider in front and higher than wide; *clypeus* vertical, and not as high as the quadrangle; *mandibles* vertical and weak; *labium* dark, wider than long; *maxillæ* pale, about twice as long as labium and inclined so that the tips are almost touching; *sternum* pale, triangular, almost as wide as long, (2.5 : 3.0), widest between the first coxæ, convex, fourth coxæ separated by more than a diameter; *abdomen* wider than long, white, with a large dark basal spot and a pair of small dark, widely separated dots on the posterior half, wide dark lateral stripes which converge at the spinnerets, abdomen smooth with no hairs or bristles, venter pale; legs, 1–2–4–3, I right missing, quite short, pale, femora with a wide distal dark band, more distinct on the posterior pairs, I and II tibiæ with 3 dark ventral spots, metatarsi with 2 ventral spots, no spines, but rows of colorless hairs, longest on the posterior pairs; *epigynum,* two dark sacs beneath the surface, separated by less than a diameter.

Male. Length, 1.0 mm.

Cephalothorax pale brown, with no dark marks found in the female, anterior margin little more narrowed than in the female, cephalic portion high, almost as wide as long, no thoracic groove or depression, but a few long bristles on the median line; *eyes* more closely grouped than in the female, anterior row recurved, eyes equidistant, a.m.e. separated by less than a diameter, posterior row almost straight, eyes equidistant, p.m.e. largest of the eight, surrounded by red, separated by about half a diameter, lateral eyes on a common tubercle; *quadrangle* narrower in front and higher than wide; *clypeus* about as high as quadrangle; *mandibles* long and narrow; *labium* wider than long, fused to the sternum; maxillæ and the sternum as in the female; *abdomen* oval, two-

thirds as wide as long, pale yellow with a vague gray median stripe on the posterior half, with scattered long bristles, venter pale, with the fold only slightly anterior to the middle; *legs,* IV pair missing, pale, with no spines but rows of hairs; *palpus,* left palpus missing, not as long as the cephalothorax, very simple and best understood from the figure.

Holotype ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Allotype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

The male and female differ in size, shape and color markings, but they probably belong together as they have the same three structural characters that are unusual in the Theridiidæ, the posterior median eyes the largest, the convex sternum and the relatively short legs. The female is quite conspicuous with the distinct dark markings on the cephalothorax and the abdomen, and the abdomen much wider than long.

Family Argiopidæ
Genus *Tetragnatha* Latreille 1804

Tetragnatha parva spec. nov.

Figures 5, 8

Male. Length, 3.0 mm., without mandibles, ceph. 1.1 mm. long, 0.8 mm. wide, abd. 2.0 mm. long, 0.6 mm. wide.

Cephalothorax a deep yellow, anterior margin little narrowed, cephalic portion slightly raised, no thoracic groove but a slight transverse depression; *eyes* cover the anterior margin, each eye heavily ringed with black, anterior row slightly recurved, a.m.e. separated by less than a diameter, a.l.e. very small, posterior row recurved, eyes subequal with a.m.e., p.m.e. separated by little more than a diameter and from p.l.e. by about a diameter and a half, lateral eyes on separate tubercles that touch at the base but the eyes are separated by more than a diameter of p.l.e.; *quadrangle* narrower in front and wider behind than high; *clypeus* almost wanting below a.m.e.; *mandibles* porrect, basal two-thirds swollen, with a sharp tooth or cusp at the end of the swollen area, fang groove

oblique, upper margin with three sharp teeth near the base of the fang, followed by a much smaller tooth, lower margin with one small tooth opposite the group of three teeth on the upper margin, fang long and curved; *labium* pale, about as wide as long, tip rebordered; *maxillæ* pale, two and a half times as long as the labium, sides parallel; *sternum* pale brown, triangular, widest between the first coxæ, pointed between the fourth coxæ; *abdomen* pale, with a darker branched median stripe, darker at the tip than at the base, about three times as long as wide, cylindrical, venter pale, spinnerets at the tip; *legs,* 1–2–4–3, anterior pairs much longer than the posterior pairs, pale, distal joints darker, no spines and few hairs; *palpus* longer than the cephalothorax, basal joints white, tibia very little longer than the patella, palpus of the usual *Tetragnatha* type, paracymbium about reaches the tip of the bulb, embolus rests on the conductor that is as long as the cymbium.

Holotype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1914 (Beatty).

Paratype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Tetragnatha parva is much smaller than the other species of the genus found in the Caribbean. Like *T. tenuissima* Cambr., it has no spines on the legs, but the most unusual character is the few teeth on the margin of the fang groove, with the absence of the "large tooth" usually found on the upper margin. The tubercles of the lateral eyes touch at the base, but the eyes are distinctly separated.

Family Salticidæ

Genus *Agobardus* Keyserling 1884

Agobardus blandus spec. nov.

Figure 6

Female. Length, 3.0 mm., ceph. 1.6 mm. long, 1.2 mm. wide, abd. 1.6 mm. long, 1.2 mm. wide.

Cephalothorax, a dark shining brown with a pale median stripe from the thoracic groove to the posterior margin, in life this stripe probably covered with white

scales as a few remain, a few white scales about the eyes, a narrow marginal stripe of white scales from the second coxæ to the posterior margin, cephalothorax high, sloping gradually from the groove to the posterior margin, anterior margin very little narrowed, thoracic groove short in a semi-circular depression between the dorsal eyes; *eyes,* anterior row covers the margin, recurved by the upper margins, a.m.e. very large, separated by a line, a.l.e. less than a radius of a.m.e. and separated from them by a line, second row of eyes midway between the first and third rows, dorsal eyes on the extreme margin of the carapace and slightly larger than a.l.e.; *quadrangle* same width in front as behind; *clypeus* about wanting below a.m.e., with a fringe of white hairs and a long recurved bristle between the a.m.e.; *mandibles* dark brown, vertical, no hairs or scales, fang groove short and oblique, upper margin with two small teeth, lower margin with a plate with two cusps, fang short; *labium* brown, slightly longer than wide, tip rebordered; *maxillæ* pale, almost twice as long as labium; *sternum* pale, almost as wide as long, (4.0:4.5), first coxæ separated by more than a diameter, fourth coxæ almost touching; *abdomen* oval, about two-thirds as wide as long, pale, with a pair of wavering dark stripes which end at a narrow curved cross band just above the spinnerets, and a pair of lateral dark stripes which join the median pair above the cross bar and reach the spinnerets, the entire abdomen covered with short white hairs, venter pale with a pair of widely separated black spots just anterior to the spinnerets, spinnerets long and closely grouped; *legs,* I pair missing, 4–3–2, pale, II femur with a large prolateral dark spot, posterior femora with a dark basal dorsal spot, and a distal dark ring, spines, II pair, patella, prolateral, 1, tibia, ventral, 2–2–2, prolateral, 3, retrolateral, 1, metatarsus, ventral, 2–2, basal pair very long, lateral, 2; epigynum only faintly chitinized, a pair of circular sacs beneath the surface, not quite touching, best understood from the figure.

Holotype ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Agobardus blandus is probably related to *Agobardus tetuani* (Petr.) (Emathis), from Tetuan Mountain, near Jayuya and also from Rio Piedra, Puerto Rico. The latter species has five cusps on the plate of the fang groove, and the cephalothorax has a large pale lateral spot each side. The abdominal dark marks also, differ. It is not impossible, that each mountain has a distinct species of this genus.

Genus *Habronattus* F.O.P.–Cambridge 1901

Habronattus pretiosus spec. nov.

Figures 7, 9

Male. Length, 3.6 mm., ceph. 2.0 mm. long, 1.5 mm. wide, abd. 1.6 mm. long, 1.1 mm. wide.

Cephalothorax dark brown, ocular area thickly covered with white iridescent scales and longer dark bristles with the posterior margin between the dorsal eyes sharply defined by a dark band, curved lateral stripes of the white scales from the dorsal eyes to the posterior slope where they end abruptly, a broad marginal stripe of white scales ending abruptly above the second pair of legs, cephalic portion high, gradually rising to the thoracic groove when it falls gradually until about one-fifth from the posterior margin where it drops rapidly, widest posterior to the second pair of legs, thoracic groove short, in a semicircular depression, in a line between the dorsal eyes; *eyes,* anterior row recurved, so that the upper margins form a straight line, a.m.e. separated by a line, and from a.l.e. by a little more, a.l.e. about one-half a diameter of a.m.e., eyes of second row very small and midway between the first and third rows, dorsal eyes slightly larger than a.l.e.; *quadrangle* slightly wider behind than in front; *clypeus* about as wide as a diameter of a.m.e., thickly covered with white scales which join with the marginal stripe that ends at the second pair of legs; *mandibles* brown, small, vertical, fang groove very short, upper margin with three contiguous teeth, lower margin with one tooth; *labium* brown, as wide as long; *sternum* oval, margins dark and center pale, I coxæ separated by less than a diameter, IV coxæ touching, the dark area with long white hairs;

abdomen oval, with a white basal band that continues as lateral stripes to the spinnerets, a pair of dark stripes that unite above the spinnerets with inner margins irregular, leaving a pale median stripe, venter with three dark stripes united in front of the spinnerets by a short dark band; *legs,* 3–4–1–2, I pair heaviest, dark brown, with a distinct prolateral darker stripe on the femur, patella and tibia, the dark area on the femur flattened, II, III and IV pairs pale, with dark rings at the base and distal ends of femur and tibia, patella with a pair of dark spots near tip, spines, I pair, patella, 0, tibia, ventral, 2–2,lr, metatarsus, ventral, 2–2, III and IV tibiæ with a dorsal, basal spine and a ventral retrolateral spine near the base; *palpus* not as long as cephalothorax, femur and patella with white iridescent scales on the dorsal side, tibia and cymbium dark, with coarse dark hairs, tibia not as long as patella, tibial apophysis dark, shining and pressed close to the cymbium, palpal organ of the usual type with the outer process longer and starting from the side and ending in a slender tip at the end of the cymbium, the inner process heavier, starts about the middle of the bulb and ends about opposite to its origin.

Female. Length, 3.0 mm., ceph. 1.6 mm. long, 1.1 mm. wide, abd. 1.9 mm. long, 1.2 mm. wide.

Cephalothorax dark chestnut-brown, ocular area thinly covered with golden iridescent scales which continue in parallel lateral stripes from the dorsal eyes and end abruptly above the posterior margin, these lateral stripes are shorter than in the male, marginal stripe of white scales on the posterior margin only, cephalothorax high, sides not as much rounded as in the male, thoracic groove short, in a semi-circular depression; *eyes* as in the male; *clypeus* equals about half a diameter of a.m.e., brown, with scattered golden scales, palpus, femur and patella covered with white scales; *mandibles* brown, vertical, mouth parts as in the male; *sternum* brown; *abdomen* with three dark triangles, one median and basal, and the other two lateral, just posterior to the middle, posterior to the basal triangle, a transverse pale band of white iridescent scales, the median area between the dark lateral

triangles pale brown, with vague chevrons on the posterior half, ventor pale with a large dark rectangle from the fold to the spinnerets; *legs,* 3–4–1–2, pale, femora with ventral distal and basal dark spots, spines as in the male; *epigynum* with the parts only lightly chitinized, a pair of widely separated spermatheca beneath the surface in the posterior part, anteriorly, a pair of oblique oval sacs with a small dark spot at the tips which probably are openings, middle area a circular depression, best understood from the figure.

Holotype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Allotype ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Paratypes ♂ 2 ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

The male and female *Habronattus pretiosus* have several characters in common as do several other species of the genus. Both have the eye area covered with scales, white in the male and golden in the female; the legs have the same dark ventral spots on the femora but only the male has the prolateral surface of the first femur flattened and covered with white scales. The lateral stripes of iridescent scales on the cephalothorax that end abruptly on the posterior slope are very conspicuous and are common to both male and female. The flattened area on the first femur of the male has not been seen before in the genus and is very conspicuous.

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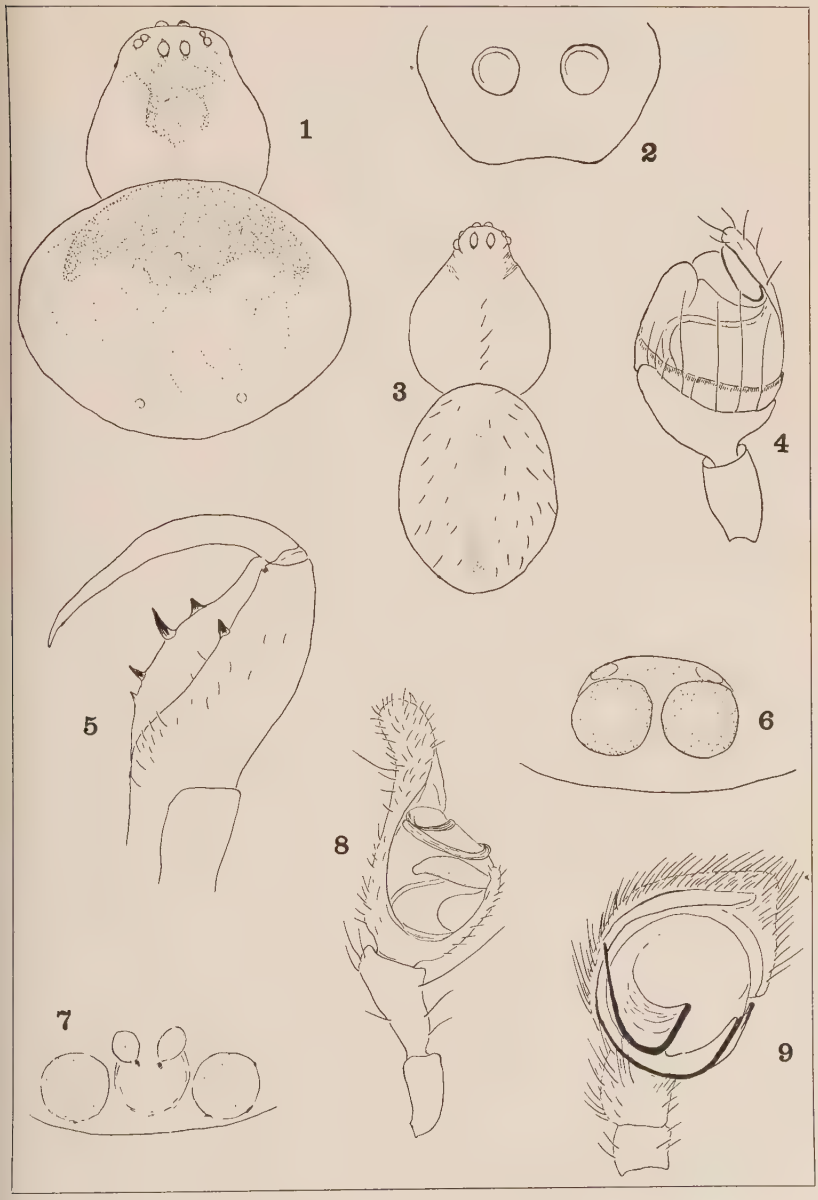
Petrunkevitch, Alexander. 1929–1930. The Spiders of Porto Rico. Trans. Conn. Acad., pt. 1, 30, pp. 1–158, 150 figs.; pt. 2, 30, pp. 159–358, 240 figs., pt. 3, 1930, 31, pp. 1–191, 168 figs.

Explanation of Plate

Fig. 1. *Allodipœna dianæ* spec. nov., female, dorsal.
Fig. 2. *Allodipœna dianæ* spec. nov., epigynum.
Fig. 3. *Allodipœna dianæ* spec. nov., male, dorsal.
Fig. 4. *Allodipœna dianæ* spec. nov., right palpus.
Fig. 5. *Tetragnatha parva* spec. nov., left mandible, ventral.
Fig. 6. *Agobardus blandus* spec. nov., epigynum.
Fig. 7. *Habronattus pretiosus* spec. nov., epigynum.
Fig. 8. *Tetragnatha parva* spec. nov., left palpus.
Fig. 9. *Habronattus pretiosus* spec. nov., left palpus.

PSYCHE, 1947 VOL. 54, PLATE 16



BRYANT—SPIDERS FROM PUERTO RICO

CATALOGUE OF RECENT AND FOSSIL NEMESTRINIDÆ OF AMERICA NORTH OF MEXICO

By Joseph C. Bequaert

Museum of Comparative Zoölogy, Cambridge, Mass.

The present compilation arranges all published references of North American Nemestrinidæ, known to the author, so as to present a reliable key to the literature and a clear historical view of the subject. All citations have been checked with the originals. The actual date of publication follows the author's name while any other date mentioned in connection with the work is inserted in parentheses after the abbreviated title and volume number. The type localities and present location of the types are noted with the original descriptions of either sex. Other references mention localities based on new material, as well as important biological data. I have used the opportunity to publish additional localities for some of the forms.

The abbreviations have been chosen so that even the beginner and non-specialist will be able to trace them in the literature. In my experience Catalogues are more useful to the uninitiated than to the strict specialist. The following abbreviations are used for the depositories of types: A.M.N.H. for American Museum of Natural History, New York; Brit. Mus. for British Museum (Natural History), London; Kansas Un. for Department of Zoölogy and Entomology, University of Kansas, Lawrence, Kansas; M.C.Z. for Museum of Comparative Zoölogy, Cambridge, Massachusetts; Melander Coll. for private collection of A. L. Melander, now at Riverside, California; Painter Coll. for private collection of R. H. Painter, now at Manhattan, Kansas; Peabody Mus. for Peabody Museum of Yale University, New Haven, Connecticut; U. Colo. Mus. for Museum of the University of Colorado, Boulder, Colorado; and U.S.N.M. for United States National Museum, Washington, D. C.

The Catalogue covers the Dominion of Canada and the United States, no species being known from Alaska. This area includes the major part of the Nearctic Region, which, as is well known, extends some distance into Mexico, its southern boundary being irregular and often disputed. Two of the species here listed are known also from farther south, extending to Guatemala in one case and to Panama in the other. Moreover, most probably some of the other forms will also be taken eventually south of the Mexican border. On the other hand, three additional species, *Neorhynchocephalus mexicanus* Bequaert, *Hirmoneura* (*Neohirmoneura*) *psilotes* Osten Sacken, and *Hirmoneura* (*Hyrmophlæba*) *brevirostris* Macquart, are known from Mexico and Central America. One or more of these might possibly yet be discovered in the southwestern United States. With this reservation, it is doubtful whether many additions will be made in the future to the Recent Catalogue. In any case, such additions will not alter appreciably the general character of the fauna.

Even if we include the Mexican and Central American forms, the Nearctic nemestrinid fauna is very scant, consisting of only nine species and one subspecies. These are now placed in three subfamilies and three genera, an unusually high proportion of supra-specific groups. All the species are precinctive; while one of the three genera only (*Neorhynchocephalus*) is strictly American, occurring as far south as Argentina. The other two genera (*Hirmoneura* and *Trichopsidea*) are nearly cosmopolitan; but the Nearctic species belong to peculiarly American subgenera (*Neohirmoneura, Hyrmophlæba,* and *Parasymmictus*).

Throughout the world the majority of Recent Nemestrinidæ occur in five widely separated areas: the Nearctic Region; the warm temperate areas of Chile and Argentina; the Mediterranean subregion and Central Asia; Africa south of the Zambesi; and Australasia. In point of number of species, the Nearctic Region is the poorest of these five areas. The Recent North American members of the family appear to be remnants of what may

have been a flourishing fauna at some earlier geological period. This is strongly suggested by the relatively rich fossil fauna. One set of Miocene strata in one locality has now yielded five species, belonging to at least three genera, one of the latter no longer found in the New World. The fact that only one fossil species is known outside North America makes this even more remarkable. Bequaert and Carpenter (1936) have commented upon the astonishing similarity between the Miocene and Recent Nemestrinidæ. The evolution of the family seems to have been at a standstill since mid-Tertiary times, which also points to the great antiquity of the group.

RECENT SPECIES

Family Nemestrinidæ

Nemestrinidæ Macquart, 1834, Hist. Nat. Ins. Dipt., I, p. 370.

Fallenina Rondani, 1856, Dipt. Italicæ Prodr., I, p. 33 and 161.

Nemestrinidii Bigot, 1856, Ann. Soc. Ent. France (3) IV, pp. 63 and 85.

Nemestrinites Walker, 1857, Trans. Ent. Soc. London (N. S.) IV, pt. 5, p. 133.

Hirmoneuridæ H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, pp. ix and 317 (Dipteren-Fauna Südafrikas, I, pp. ix and 245).

Nemistrinidæ Williston, 1883, Canad. Entom., XV, p. 69.

Subfamily Hirmoneurinæ

Hirmoneurina H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, p. ix (Dipteren-Fauna Südafrikas, I, p. ix).

Hirmononeurina H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, p. 318 (Dipteren-Fauna Südafrikas, I, p. 246).

Hirmoneurinæ Bequaert, 1930, Psyche, XXXVII, p. 295.

Hirmoneura Meigen

Hirmoneura Meigen, 1820, Syst. Beschr. Europ. Zweifl.

Ins., II, p. 132 (monotypic for *Hirmoneura obscura* Wiedemann, 1820).

Hirmonevra Blanchard, 1840, in Brullé, Hist. Nat. Anim. Articulés, III, p. 387 (emendation of *Hirmoneura;* same type).

Hyrmoneura Rondani, 1864, Arch. Zool. Modena, III, p. 50 (misspelling of *Hirmoneura;* same type).

Hermoneura Philippi, 1865, Verh. Zool. Bot. Ges. Wien, XV, p. 655, footnote (emendation of *Hirmoneura;* same [subg.] type).

clausa Osten Sacken. See *Trichopsidea.*

Subgenus *Neohirmoneura* Bequaert

Hirmoneura subg. *Neohirmoneura* Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 306 (type by original designation: *Hirmoneura flavipes* Williston, 1886).

1. *H.* (*Neohirmoneura*) *bradleyi* Bequaert.

Hirmoneura (*Neohirmoneura*) *bradleyi* Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 301, fig. (on p. 302) (holotype ♀ and allotype ♂: Anhalt, Comal Co., Texas.—Both A.M.N.H.; paratypes: Helotes, Bexar Co., Texas).

Hirmoneura bradleyi Hull, 1923, Ent. News, XXXIV, p. 277 (Texas: Bee Creek Canyon near Austin; Austin). Bequaert and Carpenter, 1936, Jl. of Paleontology, X, p. 396, fig. 1.

Distr.: Tex.

2. *H.* (*Neohirmoneura*) *flavipes* Williston.

Hirmoneura flavipes Williston, 1886, Trans. Amer. Ent. Soc., XIII, p. 292 (holotype ♀: "United States."—Kansas Un.). Johnson, 1895, Proc. Ac. N. S. Philadelphia, XLVII, p. 325 ("Florida"; erroneous locality). Aldrich, 1905, Smithson. Misc. Coll., XLVI, No. 1444, p. 218. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, pp. 251 and 252 (erroneously given as ♂). Lichtwardt, 1910, Deutsch. Ent. Zeitschr., p. 589. Schaeffer,

1912, Jl. New York Ent. Soc., XX, p. 296 (Arizona: Huachuca Mts.). Johnson, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, p. 54 ("Florida"; erroneous locality). Hunter, 1914, Kansas Un. Sci. Bull., VIII, pt. 1, p. 19 (type in Snow Coll., Kansas Un.).

Hermoneura flavipes Kertész, 1909, Cat. Dipt., IV, p. 26.

Hirmoneura (*Neohirmoneura*) *flavipes* Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 306 (♀♂); 1934, *op. cit.*, XLII, p. 176 (allotype ♂: Huachuca Mts., Cochise Co., Arizona.—M.C.Z. Also Arizona: Pinery Canyon, Chiracahua Mts., 6,500 ft., Cochise Co.; Post Creek Canyon, Pinaleño Mts., Fort Grant, 6,000 ft., Graham Co.).

Distr.: Ariz.

Subgenus *Hyrmophlæba* Rondani

Hyrmophlæba Rondani, 1864, Arch. Zool. Modena, III, p. 51 (monotypic for *Hirmoneura brevirostris* Macquart, 1845).

Hirmophlæba Bigot, 1881, Ann. Soc. Ent. France, (6) I, p. 17 (misspelling of *Hyrmophlæba;* same type).

Hyrmophlœba Curran, 1934, Fam. Gen. North Am. Dipt., p. 202 (misspelling of *Hyrmophlæba;* same type).

Hirmophlœba Curran, 1934, Fam. Gen. North Am. Dipt., p. 202 (misspelling of *Hyrmophlæba;* same type).

3. *H.* (*Hyrmophlæba*) *texana* Cockerell.

Hirmoneura texana Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 253 (holotype ♂: New Braunfels, Texas.—Melander Coll.) [1908, Amer. Jl. Sci., (4) XXV, p. 311, fig. (on p. 310); as *Hirmoneura* B]; 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Lichtwardt, 1910, Deutsch. Ent. Zeitschr., p. 591.

Hyrmophlæba texana Bequaert, 1920, Jl. New York Ent. Soc., XXVII, (for 1919), p. 306.

Hirmoneura (*Hyrmophlæba*) *texana* Bequaert, 1934, Jl. New York Ent. Soc., XLII, p. 178 (allotype

♀: Helotes, Bexar Co., Texas.—M.C.Z. Also Texas: Nueces R., Uvalde Co.; Sabinal R., Uvalde Co. Arizona: Post Creek Canyon, Pinaleño Mts., Fort Grant, 6,000 ft., Graham Co.

Hirmophlœba texana Curran, 1934, Fam. Gen. North Am. Dipt., p. 202, figs. 3–4.

Distr.: Tex., Ariz. Also Panama (Tapia, collected by G. Fairchild).

3*a*. *H.* (*H.*) *texana* var. *arizonensis* Bequaert.

Hirmoneura (*Hyrmophlœba*) *texana* var. *arizonensis* Bequaert, 1934, Jl. New York Ent. Soc., XLII, p. 180 (holotype ♂: San Diego Canyon, Baboquivari Mts., 25 miles SE of Sells, Pima Co., Arizona.—Painter Coll.; allotype ♀: Baboquivari Mts., Pima Co., Arizona.—Kansas Un.).

Additional Record.—Arizona: Tucson, many ♀♂, September 3 (F. M. Carpenter).

Distr.: Ariz.

Subfamily Nemestrininæ

Rhynchocephalina H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, p. x (Dipteren-Fauna Südafrikas, I, p. x).

Nemestrininæ Bequaert, 1930, Psyche, XXXVII, p. 286.

Neorhynchocephalus Lichtwardt

Neorhynchocephalus Lichtwardt, 1909 (July), Deutsch. Ent. Zeitschr., p. 512 (for 2 species; type by designation of Bequaert, 1930: *Rhynchocephalus volaticus* Williston, 1883).

Rhynchocephalus subg. *Nemestrinopsis* Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 285 (type by original designation: *Rhynchocephalus volaticus* Williston, 1883).

1. *N. sackenii* (Williston).

Rhynchocephalus sackenii Williston, 1860, Trans. Conn. Ac. Sci., IV, p. 243, fig. (holotype ♀: Olympia, State of Washington.—Kansas Un.). Hine, 1904, Canad. Entom., XXXVI, pp. 86 and

90 (British Columbia: Vernon). Schaeffer, 1912, Jl. New York Ent. Soc., XX, p. 296 (Arizona: Huachuca Mts.).

Rhynchocephalus sackeni Williston, 1883, Canad. Entom., XV, pp. 70 and 71 (allotype ♂: State of Washington.—Kansas Un.); 1894, Ent. News, V, p. 47 (oviposition. Colorado: Colorado Springs). Snow, 1903, Kansas Un. Sci. Bull., II, pt. 5, p. 214 (Kansas: Clark Co.; Morton Co.). Aldrich, 1905, Smithson. Misc. Coll., XLVI, No. 1444, p. 219. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 249, Pl. XVI, figs. 1 and 3 (Colorado: Ft. Collins). Kertész, 1909, Cat. Dipt., IV, p. 30. Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Hunter, 1914, Kansas Un. Sci. Bull., VIII, pt. 1, p. 19 (type in Snow Coll., Kansas Un). Gibson, 1916, 46th Ann. Rept. Ent. Soc. Ontario (for 1915), p. 211. Cole and Lovett, 1921, Proc. Calif. Ac. Sci., (4) XI, p. 239 (Oregon: Forest Grove; Mary's Peak; Corvallis; Lewisburg; Union Co.). Robertson, 1928, Flowers and Insects, p. 47 (Illinois: Carlinville, at fl. of *Achillea millefolium*). Curran, 1931, Canad. Entom., LXIII, pp. 69 and 72 (California).

Neorhynchocephalus sackeni Lichtwardt, 1909, Deutsch. Ent. Zeitschr., p. 512; 1910, *op. cit.*, p. 593 (♂♀). Bequaert, 1930, Psyche, XXXVII, p. 291 (♀♂. State of Washington: Yakima River; Rock Lake. Oregon: Mt. Angel. California: Goose Lake, Medoc Co. Idaho: Grangeville; Whitebird. Utah: Mill Creek; Salt Lake City. Colorado: Boulder. New Mexico: West Canyon Camp, Koehler); 1932, Zoolog. Anzeiger, C, p. 33. James, 1938, Jl. Kansas Ent. Soc., XI, p. 21 (Colorado: Boulder; Masonville; Spring Canyon, Fort Collins; Horsetooth Gulch, Fort Collins; Crystal Springs Country Club, Flagler; Fort Collins). Spencer, 1945, Proc. Ent. Soc. British Columbia, XLII, p. 18 (British Columbia: Kamloops. Bred from *Melanoplus m. mexicanus;* descr. of larva).

Neorhynchocephalus sackenii Bequaert, 1934, Jl. New York Ent. Soc., XLII, pp. 165 and 169 (♀♂; oviposition. State of Washington: Spanaway, Pierce Co.; Roy, Pierce Co. Oregon: Salem, Marion Co. Utah: Mt. Buncombe near Logan, Cache Co., 10,000 ft. Kansas: Manhattan, Riley Co.; Medora, Reno Co.; Kiowa Co.; Scott Co.; Cheyenne Co.; Norton Co.; McPherson Co. Oklahoma: Lawton, Comanche Co. Arkansas: Springdale, Washington Co. Michigan: Douglas Lake, Cheboygan Co.).

Rhynchocephalus subnitens Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 250 (holotype ♀: Clark Co., Kansas, 1,960 ft.—Melander Coll.); 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Schaeffer, 1912, Jl. New York Ent. Soc., XX, p. 296 (Arizona: Huachuca Mts.). Curran, 1931, Canad. Entom., LXIII, pp. 69 and 72.

Neorhynchocephalus subnitens Lichtwardt, 1910, Deutsch. Ent. Zeitschr., p. 593.

Rhynchocephalus clausus Brauer, 1880, Offenes Schreiben Antwort Osten Sacken's "Critical Review," p. 8 (Colorado). Not of Osten Sacken, 1877.

Additional Records.—Oregon: Bush's Pasture, Salem (G. F. Smith); [also Sparta, Baker Co., according to T. H. G. Aitken, *in litt.*]—California: Santa Cruz.

Distr.: Brit. Col., Wash., Ore., Calif., Ida., Ut., Ariz., Colo., N. M., Kans., Okla., Ark., Mich., Ill.

2. *N. volaticus* (Williston).

Rhynchocephalus volaticus Williston, 1883, Canad. Entom., XV, pp. 70 and 71, fig. 4 (described from 2 ♀ cotypes, from "Florida"; the type locality is Georgiana, Florida, according to Bequaert, 1934, Jl. New York Ent. Soc., XLII, p. 167, footnote.—Lecto-holotype at Kansas Un; cotype at U.S.N.M.); 1886, Trans. Amer. Ent. Soc., XIII, p. 293 (descr. corrected); 1888, Synopsis North Amer. Dipt., p. 33, fig. Johnson, 1895, Proc. Ac. Nat. Sci. Philadelphia, XLVII, p. 325 (Florida:

St. Augustine). Aldrich, 1905, Smithson. Misc. Coll., XLVI, No. 1444, p. 219. Williston, 1908, Manual North Amer. Dipt., 3d Ed., p. 186, fig. 68. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 250. Kertész, 1909, Cat. Dipt., IV, p. 30. Hunter, 1914, Kansas Un. Sci. Bull., VIII, pt. 1, p. 19 (type in Snow Coll., Kansas Un.). Curran, 1931, Canad. Entom., LXIII, pp. 69 and 72.

Neorhynchocephalus volaticus Lichtwardt, 1909, Deutsch. Ent. Zeitschr., p. 512; 1910, *op. cit.*, p. 593, fig. 2 (on p. 592). Johnson, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, p. 54. Hull, 1923, Ent. News, XXXIV, p. 275 (Mississippi: A. and M. College near Starkville; West Point. Texas: Kingsville; Raymondville). Bequaert, 1930, Psyche, XXXVII, p. 290 (Texas: Cotula; Nueces R. Kansas: Bourbon Co., 800 ft.; Sumner Co., 1189 ft.; Lawrence; Douglas Co.); 1934, Jl. New York Ent. Soc., XLII, pp. 165 and 166, figs. 1E–G (on p. 172) (Kansas: Atchison Co.; Morris Co.; Medicine Lodge, Barber Co.; Onaga, Pottawatomie Co.; Riley Co.; Cowley Co.; Doniphan Co.; Saline Co.; Manhattan, Riley Co.; Leavenworth Co.; Dickinson Co. Oklahoma: Arbuckle Mts., Murray Co. Florida: Sanford, Seminole Co.; Wildwood, Sumter Co. Missouri: Hollister, Taney Co. Arizona: San Diego Canyon on west side of Baboquivari Mts., 25 miles SE of Sells, Pima Co. At fl. of *Houstonia* in Kansas; descr. pupa). Curran, 1934, Fam. Gen. North Am. Dipt., p. 202, figs. 5–6.

Rhynchocephalus (*Neorhynchocephalus*) *volaticus* Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, pp. 285 and 286.

Rhynchocephalus maculatus Curran, 1931, Canad. Entom., LXIII, p. 69 (cotypes ♀♂: Lawrence, Kans.—Kansas Un.).

Rhynchocephalus flavus Curran, 1931, Canad. Entom., LXIII, pp. 69 and 70 (holotype ♂: Harper Co., Kansas; allotype ♀: Sumner Co., Kan-

sas.—Both Kansas Un. Also paratypes Kansas: Bourbon Co.; Cherokee Co.; Waubaunsee Co.).

Additional Records.—Florida: Indian River (Whitfeld); Monticello (G. Fairchild).—Missouri: Willard, Greene Co. (A. E. Brower).

Distr.: Ariz., Kans., Okla., Mo., Tex., Miss., Fla. Also Mexico (Baja California, Sinaloa, Guerrero, Colima, Morelos, Veracruz, Oaxaca, Yucatan) and Guatemala.

Rhynchocephalus Fischer, 1806

clausus Brauer (not Osten Sacken). See *Neorhynchocephalus sackenii.*

flavus Curran. See *Neorhynchocephalus volaticus.*

maculatus Curran. See *Neorhynchocephalus volaticus.*

sackenii Osten Sacken. See *Neorhynchocephalus.*

subnitens Cockerell. See *Neorhynchocephalus sackenii.*

volaticus Williston. See *Neorhynchocephalus.*

Subfamily Trichopsideinæ

Trichopsideinæ Bequaert, 1932, Zoolog. Anzeiger, C, p. 33.

Trichopsidea Westwood

Trichopsidea Westwood, 1839, Trans. Ent. Soc. London, II, p. 151 (monotypic for *Trichopsidea oestracea* Westwood, 1839).

Subgenus *Parasymmictus* Bigot

Parasymmictus Bigot, 1879, Ann. Soc. Ent. France, (5) IX, Bull. Séances, p. lxvii (monotypic for *Hirmoneura clausa* Osten Sacken, 1877).

Parasymmyctus Curran, 1934, Fam. Gen. North Am. Dipt., p. 202 (misspelling of *Parasymmictus;* same type).

1. *T.* (*Parasymmictus*) *clausa* (Osten Sacken).

Hirmoneura clausa Osten Sacken, 1877, Bull. U. S. Geol. Survey, III, pt. 2, p. 225 (holotype ♂, erroneously given as ♀: Dallas, Texas.—M.C.Z.); 1878, Smithson. Misc. Coll., No. 270, pp. 85 and

237. Williston, 1883, Canad. Entom., XV, p. 70. Osten Sacken, 1898, Berlin. Ent. Zeitschr., XLII (for 1897), p. 148. Aldrich, Smithson. Misc. Coll., XLVI, No. 1444, p. 218.

Parasymmictus clausus Bigot, 1879, Ann. Soc. Ent. France (5) IX, Bull. Séances, p. lxvii; 1881, *op. cit.* (6) I, p. 15. Kertész, 1909, Cat. Dipt., IV, p. 31. Lichtwardt, 1910, Deutsch. Ent. Zeitschr., pp. 589 and 591. Johnson, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, p. 54 (Florida: Beresford). Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 306. J. Comstock, 1924, Introduction to Entomology, p. 836, fig. 1077. Spencer, 1945, Proc. Ent. Soc. Brit. Columbia, XLII, p. 18 (British Columbia: Riske Creek, Chilcotin; Lac du Bois, Kamloops. Oviposition; descr. larva; bred from *Camnula pellucida* and other grasshoppers).

Hirmoneura (*Parasymmictus*) *clausa* Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 251; 1908, Amer. Jl. Sci. (4) XXV, p. 311, fig. (on p. 310); 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.

Trichopsidea (*Parasymmictus*) *clausa* Bequaert, 1934, Jl. New York Ent. Soc., XLII, pp. 181 and 182 (Kansas: Medora, Reno Co.).

Parasymmyctus clausus Curran, 1934, Fam. Gen. North Am. Dipt., p. 202, figs. 1–2.

Rhynchocephalus sackeni J. and A. Comstock, 1895, Manual Study Insects, 1st. Ed., p. 460, fig. 555 (repeated in later editions of this work). Spencer, 1931, Proc. Ent. Soc. Brit. Columbia, XXVIII, p. 21, figs. (on p. 24) (British Columbia: Riske Creek, Chilcotin. Oviposition); 1932, *op. cit.*, XXIX, p. 25 (oviposition). Graham, 1932, Canad. Entom., LXIV, p. 167 (British Columbia. Variation). Not of Williston, 1880.

Rhynchocephalus sp. J. Comstock, 1918, The Wings of Insects, p. 347, fig. 358.

Distr.: Brit. Col., Kans., Tex., Fla.

FOSSIL SPECIES

Subfamily Hirmoneurinæ

Hirmoneura Meigen

occultator Cockerell. See *Neorhynchocephalus.*
melanderi Cockerell. See *Neorhynchocephalus* (?).
vulcanicus Cockerell. See *Neorhynchocephalus.*

Subgenus *Hirmoneurites* Cockerell

Hirmoneurites Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, pp. 283 and 285 (monotypic for *Hirmoneurites willistoni* Cockerell, 1910).

1. *H.* (*Hirmoneurites*) *willistoni* (Cockerell).
   Hirmoneurites willistoni Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, pp. 283 and 286, fig. 3 (on p. 283) (no sex given; holotype: Florissant, Colorado.—A.M.N.H.).
   Hirmoneura (*Hirmoneurites*) *willistoni* Bequaert, 1932, Zoolog. Anzeiger, C, p. 15. Bequaert and Carpenter, 1936, Jl. of Paleontology, X, p. 399, figs. 2 (on p. 400) and 7 (2) (on p. 405) (holotype ♀).

Distr.: Miocene of Colo.

Subfamily Nemestrininæ

Neorhynchocephalus Lichtwardt

1. *N. occultator* (Cockerell).
   Hirmoneura occultator Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 254 (no sex given; holotype: Florissant, Colorado.—Obverse at U. Colo. Mus.; reverse at Brit. Mus.). Bather, 1909, Proc. Geologists' Assoc., XXI, pt. 3, p. 162 (type at Brit. Mus.). Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.
   Neorhynchocephalus occultator Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 402, figs. 4 (on p. 400) and 7 (1) (on p. 405) (obverse of type ♀).

Distr.: Miocene of Colo.

2. *N. vulcanicus* (Cockerell).

Hirmoneura vulcanica Cockerell, 1908, Amer. Jl. Sci. (4) XXV, p. 311 (no sex given; holotype: Florissant, Colorado.—Obverse at Peabody Mus.; reverse at U. Colo. Mus.); 1908, Trans. Amer. Ent. Soc., XXXIV, pp. 251 and 253; 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.

Neorhynchocephalus vulcanicus Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 401, figs. 3 (on p. 400) and 7 (4) (on p. 405) (obverse and reverse of type ♀).

Distr.: Miocene of Colo.

Generic Position Doubtful

3. *N.* (?) *melanderi* (Cockerell).

Hirmoneura melanderi Cockerell, 1908, Amer. Jl. Sci. (4) XXV, p. 311 (no sex given; holotype: Florissant, Colorado.—Obverse at Peabody Mus.; reverse at U. Colo. Mus.); 1908, Trans. Amer. Ent. Soc., XXXIV, pp. 251 and 253; Pl. XVI, fig. 4 (add. specimen, prob. ♀, Florissant); 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.

Neorhynchocephalus (?) *melanderi* Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 403, figs. 5 (on p. 400) and 7 (3) (on p. 405) (obverse and reverse of type, of doubtful sex. Also 2 add. specimens, one ♂, Florissant, at M.C.Z.).

Distr.: Miocene of Colo.

Prosœca Schiner

Prosœca Schiner, 1867, Verh. Zool. Bot. Ges. Wien, XVII, pp. 306 and 311 (type by original designation: *Nemestrina westermanni* Wiedemann, 1821).

Subgenus *Palembolus* Scudder

Palembolus Scudder, 1878, Bull. U. S. Geol. Geogr. Surv. Terr., IV, p. 526 (monotypic for *Palembolus florigerus* Scudder, 1878).

Palombolus Handlirsch, 1907, Die Fossilen Insekten, pt. 7, p. 1009 (misspelling of *Palembolus*).

1. *P.* (*Palembolus*) *florigera* (Scudder).

Palembolus florigerus Scudder, 1878, Bull. U. S. Geol. Geogr. Surv. Terr., IV, pp. 519 and 528 (no sex given; holotype: Florissant, Colorado.—Obverse and reverse at M.C.Z.); 1885, in Zittel, Handbuch d. Palaeontologie, Abt. I, II, p. 808, fig. 1076; 1887, in Zittel, Traité de Paléontologie, Barrois Ed., II, p. 809, fig. 1093; 1890, Rept. U. S. Geol. Surv. Terr., XIII, p. 29. Zittel, 1895, Grundzüge d. Palaeontologie, p. 506, fig. 1380. Scudder, 1900, in Zittel, Text-Book of Palaeontology, Eastman Ed., I, pt. 2, p. 688, fig. 1567. Zittel, 1903, Grundzüge d. Palaeontologie, 2d Ed., I, p. 542, fig. 1400. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 248; 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Scudder, 1913, in Zittel, Text-Book of Paleontology, 2d Eastman Ed., I, p. 816, fig. 1586.

Palombolus florigerus Handlirsch, 1907, Die Fossilen Insekten, pt. 7, p. 1009. Broili, 1915, in Zittel, Grundzüge d. Palaeontologie, I, p. 666, fig. 1454. Handlirsch, 1921, in Schröder, Handbuch d. Entomologie, III, p. 264, fig. 227.

Prosœca (*Palembolus*) *florigera* Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 406, figs. 6 (on p. 400) and 7 (5) (on p. 405) (obverse and reverse of type ♂).

Distr.: Miocene of Colo.

Eighth International Congress of Entomology

The eighth International Congress of Entomology will be held in Stockholm, Sweden, August 8–15, 1948. The fact that all steamship sailings are currently booked to capacity for months in advance makes it seem necessary for those expecting to attend the congress in 1948 to arrange for passage as early as possible. Steamship companies have not issued sailing lists for 1948, but expect to do so in the early fall. A number of lines have listed sailings for the present season, among them, the Cunard, French, Belgian, Swedish, Norwegian, Gdynia (Polish), Holland-American, etc., the first mentioned expecting soon to have two new steamers in service. It is understood that the Thirteenth International Congress of Zoology will be held in Paris some time in July, 1948, and it is hoped that all entomologists going to Stockholm will plan to attend the Zoological Congress also in order that the interests of the entomologists may be fully represented before the more comprehensive body. Should a sufficient number of individuals indicate that they expect to sail about mid-June, it may be feasible to engage passage on the same steamer. Early information as to the probable number of participants is especially desired in order that the housing committee in Stockholm may make the necessary arrangements. The undersigned, as member of the executive committee, would appreciate it if he be kept informed as early as possible as to plans of those expecting to attend the sessions.—O. A. Johannsen, Comstock Hall, C. U., Ithaca, N. Y. June, 1947.

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